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The Bancroft Memorial Lecture.[1]

CELLULAR RESPONSE TO INJURY.

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WE are gathered here this evening to do honour to the memory of Joseph Bancroft, who came out to this country in 1864 as a young doctor of twenty-eight and settled in Brisbane, where he spent the remaining thirty years of his life. Bancroft's name occupies a high niche in the temple of fame, for he must be regarded as one of the pioneers in the rapid modern advance of tropical medicine. Not only did he discover the adult female of the filaria which bears his name, but he was one of the first to recognize the importance of insects in the transport of disease.

Joseph Bancroft's scientific interests were exceedingly diverse. Before he came out to Australia he studied the methods of packing trout ova for transport, and helped to pack the first batch which reached Tasmania alive. In Australia his researches had a strongly practical bias. He produced new varieties of fruits by hybridization, studied diseases in sugar cane and bananas, devised a method for preserving fish and set up a factory for the manufacture of pemmican. He was also one of the earliest workers on the pharmacology of Australian native plants.

It is good that we recall the achievements of our early scientific workers in Australia; and perhaps the best memorial to them is the presentation of the results of new Australian research which bears

[1] Delivered at Brisbane on June 3, 1938.

witness to the fact that the torch which they lighted is still being carried onward. For this reason I may perhaps be permitted to describe some recent studies, carried out at the Walter and Eliza Hall Institute of Research in Pathology and Medicine, on cellular defence against injury.

The closing years of the nineteenth century saw great advances in our knowledge concerning the defensive mechanism of the body against injury of various kinds. The brilliant studies of Metchnikoff led him to believe that in reaction to injury the dominating influence was exerted by fixed and wandering mesodermal cells, which could function as phagocytes, engulfing and destroying invading organisms and removing the debris of tissue cells which had been killed by injury.

Metchnikoff had studied the response to injury in many species throughout the animal kingdom. In the invertebrates three kinds of cellular response to injury are observed, phagocytosis, accumulation of wandering cells round introduced foreign bodies, and proliferation of fixed tissue cells to make good damage caused by injury. The action of the phagocyte is foreshadowed by the amœba, which can digest, within its protoplasm, foreign bodies which it has engulfed and around which it forms vacuoles into which digestive juices are secreted. The analogy with the phagocyte is even more complete; for sometimes after bacteria have been ingested proper formation of digestive vacuoles does not occur, so that the organisms are able to multiply and kill the amœba. In the behaviour of amœbæ and phagocytes alike chemotactic influences play an important part. In the echinoderm we meet with extracellular digestion. Foreign matter introduced into the body cavity is first surrounded by wandering cells, which form a plasmodium around it, and may then be destroyed by juices excreted from these cells. Even in the higher invertebrates there is no vascular response to injury. In the worms the mesodermal cells in the perivisceral fluid function as phagocytes, and in the arthropods phagocytic cells are met with in the blood itself.

In the vertebrates the simplest type of response is that to less severe forms of injury or to injury in special regions, and takes place without vascular reaction. Injured cells become swollen and vacuolated; foreign bodies and debris are removed by phagocytosis; and finally there is new growth of fixed tissue cells to make good the damage. The more severe types of injury are accompanied by vascular reactions which may be illustrated by the changes, described by Cohnheim, which result from the entry of pathogenic organisms into the tissues. The arteries, capillaries and veins are first dilated, and the blood flow through the part is accelerated. The next phase is the slowing of the local circulation. The polymorphonuclear leucocytes drop out of the axial blood stream in the vessels, adhere to the walls and pass through into the tissue spaces, where they fulfil their function as phagocytes. Some fall by the wayside; and their corpses, before they are finally disintegrated, form the cellular elements of pus. At the outskirts the tissue cells proliferate and wall off an abscess, and ultimately contribute to the formation of scar tissue.

In addition to these morphological changes which follow injury, there is also a chemical defensive mechanism. During the last decade of the nineteenth century the work of Nuttall, Behring and a host of others showed the importance of the antibacterial and antitoxic properties of the blood serum and of inflammatory exudates. At first there was much debate as to the relative importance of cellular and humeral defence; but this struggle for predominance has now little significance, since the formation of antibody must also be regarded as part of the cellular response to injury. Early in the present century numerous studies (notably those of Hektoen) pointed to the leucocytes and blood-forming organs as the principal seat of its formation; but the whole reticulo-endothelial system is probably involved, and there is even some evidence of local production in the cells of other tissues.

Antibody consists of globulin altered structurally so that it can unite in a specific manner with foreign protein, foreign cells or bacteria, and thus exert its effects. It precipitates foreign proteins introduced parenterally, and neutralizes specifically toxins of vegetable or animal origin. Against foreign cells and bacteria it exhibits various defensive reactions, agglutinating, facilitating phagocytosis and finally disintegrating the invaders.

It is not, however, with this extremely complicated and highly specific mechanism of defence that we are immediately concerned, but with still another chemical defence, which is applicable to all forms of injurious stimuli and in which the reagents are of simpler constitution than antibody. The tissue cells are storehouses for certain highly active substances which are liberated into the tissue spaces in response to suitable stimuli, and locally exert highly characteristic actions. Such substances are liberated when cells are injured.

In 1926 Sir Thomas Lewis published the results of the studies he and his colleagues had carried out upon the reactions of the blood vessels of the human skin to injury of various kinds. By the use of ingenious experimental methods Lewis and his co-workers opened up new and rich vistas of discovery by showing the importance of the liberation from injured epithelial cells of what has turned out to be a relatively simple chemical substance. This determines the same kind of vascular response to a widely different series of injurious agents. Pricking, scratching, freezing, burning, injury by electric stimuli and by a host of chemical irritants all produce the "triple response". This consists of (*a*) a local red reaction caused by dilatation of the capillaries; (*b*) the spreading flush or flare, a widespread dilatation of neighbouring arterioles brought about by a local nervous reflex; and (*c*) local œdema, resulting from increased permeability of the vessel walls. The "triple response" developed in the same manner and with

the same time relations, whatever the agent responsible for injury; and it was clear that in all these diverse cases it must be brought about in the same way, by the liberation of a common diffusible substance which Lewis called H-substance because of its resemblance to histamine. Here, then, was the underlying cause of the vascular response to injury. In Sir Thomas's words, "the agent that alarms the garrison and mobilizes the first or vascular defence is a chemical agent derived from the tissues". Here, too, was to be found the explanation of the vascular and exudative phenomena of skin allergy and of the slower reactions of the skin to ultraviolet light and X rays.

The phenomena of anaphylactic shock are strikingly similar to those produced by the intravenous injection of histamine. Sir Henry Dale, in his Croonian Lecture in 1929, showed how beautifully the conception of the liberation of histamine as the result of the interaction of antibody and antigen fitted most of the observed facts. Evidence from animal experiments that histamine was actually liberated from the cells in anaphylaxis was not long wanting, and the studies of Feldberg and his co-workers showed this in the sensitized guinea-pig's lung. When such organs were perfused and antigen was allowed to flow through them, bronchial constriction was produced and the outflowing perfusate contained a substance which was pharmacologically identified with histamine. The substance was liberated in amounts sufficient to cause bronchial constriction when the fluid was injected into a perfused normal lung. About the same time, Dragstedt and Gebauer-Fuelnegg showed that in sensitized dogs the injection of the anaphylactic antigen caused the appearance in the lymph of a substance with a depressor action upon arterial blood pressure and a stimulant action upon smooth muscle. The researches of Manwaring and his co-workers had earlier stressed the importance of constriction of the hepatic veins as a feature of anaphylaxis in the dog, and had found active substances in the blood of dogs in acute anaphylaxis.

Recent work at the Hall Institute has afforded still further evidence in support of the view that histamine is liberated from the tissue cells by injurious agents. In these studies snake venoms were useful reagents. In 1929 I had shown that the venoms of certain Australian snakes caused, in isolated smooth muscle, a contraction which resembled closely the contraction of sensitized smooth muscle to the anaphylactic antigen, and had suggested that this action might be indirect by the liberation of a stimulant substance like histamine. Later Le Messurier and I studied the action of the venom of the Australian copperhead in various laboratory animals and found striking resemblances between its effects and those of histamine, though we were not able to prove that histamine was liberated by it.

Dr. Feldberg took up the problem with me at this point. In our first experiments we perfused the isolated lungs of guinea-pigs with Tyrode solution. The lungs were ventilated through a tracheal cannula, and the saline solution was supplied at a steady pressure through the pulmonary artery. We found that it was possible to perfuse normal lungs for some time without gross changes in their appearance or alteration in the character of the perfusate which flowed out from the cut veins at the hilus; but when venom was injected into the cannula in the pulmonary artery the lung rapidly became œdematous and ceased to ventilate properly. There now appeared in the perfusate a substance which, when tested on the isolated intestine of the guinea-pig, caused an immediate rapid contraction like that caused by histamine. The amounts of this substance in the perfusate could be estimated by comparison with histamine, not only on the guinea-pig's intestine, but by the depressor effect on the cat's blood pressure, and by measurement of the rise of blood pressure caused by adrenaline output from the suprarenal glands, if test injections were made into their arterial supply.

Now the interesting point about these various methods of estimation was that all of them yielded approximately the same value for the amount of histamine-like substance—a fact which strongly indicated that the substance was not only like histamine, but was histamine itself. Further evidence in this direction was obtained by the demonstration that this active substance in the perfusate was actually part of the store of histamine present in the lungs. Extracts made of the tissues of the right and left lungs were found to contain approximately the same amounts of histamine. Now, if the amount of histamine of one lung was estimated and the other lung was perfused and injected with venom, it was found that the total amount of histamine present in the perfusate, together with what was found in the lung at the end of the experiment, was approximately equal to that present in the lung at the commencement of the perfusion.

The liberation of histamine from the perfused lung was not the only evidence of tissue injury brought about by the injection of snake venom. The lung assumed a curiously glassy appearance, the tissues became waterlogged and fluid oozed from the surface in large amounts, which were collected and added to the venous perfusate in the quantitative experiments I have just described. Furthermore, the outflowing fluids contained large quantities of coagulable protein, and the estimation of its amount gave some indication of the degree of tissue injury.

We studied in this way three different snake venoms—that of the Australian copperhead, *Denisonia superba*, that of the Indian cobra, *Naia naia*, and that of a North American rattlesnake, *Crotalus atrox*, and found that all of them caused somewhat similar changes in the perfused lungs and the liberation of histamine and coagulable protein in the outflowing fluids. Dr. Trethewie has recently studied two more Australian snake venoms, those of the black snake, *Pseudechis*

porphyriacus, and the death adder, *Acanthopis antarcticus*, and has found that both cause the liberation of histamine from perfused tissues.

It may be noted that in 1930 Essex and Markowitz had stressed the similarity between the results of poisoning by the venom of *Crotalus atrox* and those produced in acute anaphylaxis and by histamine. We now made further analyses of the symptoms caused by the venoms of the Australian copperhead and of the Indian cobra, which revealed further points of similarity between the action of these venoms on the circulation and that of histamine itself. There is a profound fall of systemic blood pressure following the intravenous injection of cobra venom. In the cat this is caused by obstruction in the pulmonary circulation, and in the dog it is dependent on peripheral vasodilatation, constriction of the hepatic veins and injury to the liver cells. In both species, in the same way as after the injection of histamine, there is increased hæmoglobin concentration of the blood, which results from loss of fluid from the circulation, caused by changes in the permeability of the capillaries.

These venoms, like histamine, cause engorgement and hæmorrhage into the mucosa of the small intestine in the dog. This is maximal in the duodenum, and decreases in extent from the duodenum to the lower part of the ileum. Both these venoms, like histamine, cause an increase in the outflow of lymph from the cannulated thoracic duct.

In comparing the effects of histamine with those of snake venoms in order to ascertain the rôle played by the liberation of histamine in the production of symptoms, emphasis must be laid upon the fact that histamine set free by tissue injury caused by venoms acts mainly at the site of its liberation. This fact Dragstedt, Mead and Eyer have apparently overlooked in concluding, from experiments in which they have demonstrated rather small amounts of histamine in the blood and lymph of dogs after the injection of *Crotalus* venom, that liberation of histamine plays only a subsidiary rôle in the production of symptoms by this venom.

The venom of the bee has long been known to be similar in its action to snake venoms, and, as Essex, Markowitz and Mann have pointed out, its action resembles that of histamine in many respects. Feldberg and I have been able to show that, injected into the perfused lungs of guinea-pigs and dogs and into the perfused liver of the dog, it causes prolonged diffusion of histamine from the tissues, which is accompanied by release of coagulable protein, and, in the case of liver perfusions, of bile pigments. It causes circulatory changes in the cat and dog similar to those caused by cobra venom, and, like it, also causes a prolonged increase in lymph flow from the thoracic duct and similar morbid changes in the mucosa of the small intestine. It may be noted that bee venom actually contains histamine, and that some of the effects of the poison can be related to histamine present in it. However, in specimens freed from histamine all the effects which I have just described are seen.

In many of these experiments some difficulty was introduced into the titration of histamine in the perfusates by the presence in them of other active substances. In tests on the isolated jejunum of the guinea-pig, in addition to the rapid immediate contraction, relaxation from which took place at once when the bath was washed out, we found, in unboiled perfusates, a substance or substances which caused a slow, delayed contraction of the smooth muscle which relaxed only gradually when the Tyrode solution was changed. Much of this activity could be abolished by boiling of the solutions, particularly if they contained much coagulable protein. At first we regarded this complication only as a disturbing factor which interfered with the titration of histamine; and we might have continued so to regard it had we not by chance made some experiments in which we perfused the monkey's liver with cobra venom. In these, no appreciable amount of histamine was set free in the perfusate because the liver in this species contains but little histamine. The slowly contracting substance was, however, regularly present in the perfusate, and since it was either not present, or only present in traces in extracts of monkey's liver before the injection of venom, and was present in large amounts in extracts of liver perfused with venom, we concluded that it must be formed by the action of venom in the perfused organ.

Now the venoms which cause the formation of this new active substance and its liberation into the perfusates were powerfully hæmolytic, and it seemed possible that their injurious action on the tissue cells might be of the same nature as their lytic action upon red blood cells. It is necessary at this stage to recall some of the known facts concerning hæmolysis by snake venoms. In 1904 Preston Kyes found that the hæmolytic action of snake venoms was greatly enhanced by lecithin. Kyes thought that the venoms combined with lecithin to form a powerfully hæmolytic compound. However, the later work of Delezenne and his colleagues showed that what the venom really did was to split off a molecule of oleic acid from lecithin and form an active lysocithin. It appeared conceivable that the formation of lysocithin might take place in the tissues and might alter the permeability of the cells, thus allowing the liberation of coagulable protein, histamine and other cell constituents. It also appeared possible that the slowly contracting substance which we had observed might be lysocithin itself or similar compounds formed in the tissue cells from lipins other than lecithin.

Although this theory had not been put forward in this form, a good many workers (Belfanti, Guerrini, and Houssay and his co-workers) had stressed the importance of the formation of lysocithin in the symptomatology of snake venom poisoning. It had been shown that the injection of lysocithin into animals caused symptoms which resembled, in some respects, those of snake venoms.

Now lysocithin is soluble in absolute methyl-alcohol; and alcoholic extracts of monkey's liver, which had been perfused with venom, formed a rich

source of the slowly contracting substance. It remained to be seen whether these alcoholic extracts of envenomed monkey's liver were actively hæmolytic, and whether solutions containing lysocithin made from egg lecithin resembled envenomed liver extracts in their action on the isolated guinea-pig's jejunum.

Before we discuss the results of these experiments we have to make one reservation. Crystalline lysocithin was not available, and we therefore used an alcoholic extract of the substance formed by the action of cobra venom upon egg lecithin. These extracts contained lysocithin, but there were present in addition some oleates and possibly unknown active substances formed from lecithin itself or from impurities present in our lecithin preparation. Since sodium oleate has no appreciable effect on the gut and only trivial hæmolytic action in strong concentration, we can disregard the small amounts of this substance which were present. We shall refer to these alcoholic extracts as lysocithin, though we cannot exclude the possibility that part of their activity may result from other cleavage products of lipins.

Envenomed liver, lysocithin and cobra venom were all found to have similar actions on the isolated jejunum of the guinea-pig. They caused a delayed, slow contraction from which relaxation occurred only slowly after changing of the Tyrode solution in the bath; and in each case the excitability of the muscle was altered in a similar manner after the contraction. These changes in excitability varied somewhat with different preparations of jejunum and with the dose of active substance tested. Usually they consisted of an initial increase in response to histamine or acetylcholine, then a period of decreased excitability and then a return to normal. Sometimes only increased excitability or decreased excitability was observed. Since cobra venom also causes these changes, it was important to show that no free venom was present in the lysocithin or in the extract of envenomed liver. The presence of venom was avoided by evaporating the solutions in methyl alcohol to dryness, extracting with absolute methyl alcohol, filtering and taking to dryness, and again extracting with absolute methyl alcohol. The alcoholic solution so obtained was filtered, and for use the alcohol was evaporated off and the residue was suspended in Tyrode solution. Solutions prepared in this way were free from venom. Treatment of the isolated gut with repeated doses did not cause any desensitization to cobra venom; and, on the other hand, desensitization of the jejunum with cobra venom did not affect its response to solutions of lysocithin or envenomed liver.

The extract of envenomed liver also resembled lysocithin in its hæmolytic action. Washed sheep corpuscles, which are not hæmolysed by cobra venom, were rapidly lysed by envenomed liver extract. When, however, the hæmolytic and muscle stimulant actions of envenomed liver and lysocithin were compared quantitatively, the envenomed liver was found to be more active in causing contraction of the gut than would have been anticipated from the titration of its hæmolytic activity. This difference is partly accounted for by the presence of antihæmolytic substances in alcoholic extracts of liver, but some part of the discrepancy remains unexplained. Unless all the lysocithin-like substances formed from the lipins of the liver were to show in tests of hæmolytic and muscle-stimulating power the same quantitative behaviour as lysocithin made from egg lecithin, such quantitative differences as we had observed were to be expected.

Time does not permit me to discuss fully all the points of resemblance between the pharmacological actions of lysocithin, envenomed liver and cobra venom. These substances all cause similar contractions of the isolated uterus of the guinea-pig, which can be desensitized by repeated applications of these active preparations; and if the uterus is poisoned with histamine, so that it no longer reacts by contraction to histamine, it still contracts when envenomed liver, lysocithin or cobra venom is added to the bath. The action of these substances on the isolated cat's heart exhibits some points of difference. Cobra venom causes systolic contracture of the heart. Lysocithin also causes rapid failure, but the heart ceases to beat in diastole or in the mid-position. Envenomed liver has only a feeble action; but this may be accounted for by the presence of antagonistic substances, because normal liver extracts mixed with lysocithin protect the heart from its drastic action, and the effects of such mixtures resemble those of envenomed liver.

Envenomed liver and lysocithin injected intravenously into guinea-pigs cause symptoms rather like those of acute anaphylaxis and death from bronchial constriction and asphyxia, but there is an associated hæmorrhagic œdema of the lungs which forms no part of acute anaphylaxis. Finally, envenomed liver, cobra venom and lysocithin placed in the anterior chamber of the rabbit's eye all cause opacity of the cornea, whereas extracts of the normal monkey's liver in greater concentration have no such effect.

Since our comparisons were not made with pure lysocithin it is possible that the muscle stimulant and hæmolytic actions are not properties of a single substance (lysocithin), but must be attributed to two different cleavage products, one muscle-stimulating and one hæmolytic, or to a group of cleavage products each possessing both these properties, though in different proportions.

The evidence so far presented allowed us to conclude that lysocithin-like substances are formed in the tissues by the action of venom. What now is their physiological significance? We found that both lysocithin and envenomed liver were capable of setting free histamine, coagulable protein and pigments from the perfused dog's liver, and that, when repeatedly injected, they gave effects indistinguishable from those produced by the injection of repeated small doses of cobra venom.

It seemed possible, therefore, that the formation of lysocithin-like substances might be an inter-

mediate stage in some part of the liberation of histamine by cobra venom, and further evidence in this direction was afforded by the fact that when doses of venom too small to cause appreciable liberation of histamine were injected into the perfused dog's liver they caused the output into the perfusate of substances with the characteristic stimulating action upon the isolated guinea-pig's jejunum.

The attempt to determine the more general significance of the liberation of histamine in cell injury led to the investigation of other toxic agents. So far only peptone and staphylococcal toxin have been examined, and as regards the former the experiments dealt only with the liberation of histamine. Feldberg and O'Connor found that histamine was set free from the perfused lung of the guinea-pig by peptone, though in much smaller amounts than those released by snake venom. This result agrees well with the fact that the cell injury caused by peptone is less extreme. Recently Dragstedt and his co-workers have shown that small amounts of histamine appear in the lymph from the thoracic duct of dogs after the intravenous injection of peptone.

Our studies on staphylococcal toxin were more extensive, but are not yet complete. Feldberg and Keogh found that toxin liberates histamine from the perfused lung of the guinea-pig; and Feldberg and I have shown that it is liberated from the perfused lung of the dog, and that the perfusate also contains a substance which causes slow contraction of the gut and may be identical with the similar substance formed in the tissues by snake venoms. The perfusion of the dog's liver introduced a new fact which links up with the problem of "bound" and "free" histamine. Part of the histamine is free in the perfusate, but part is present in an inactive form in cell debris, from which it can be brought into solution by heat or by the action of venom. Dr. Trethewie has made a careful study of the histamine content of extracts of normal liver, and has clearly shown that heat is effective in bringing into solution histamine which is present in inactive form in insufficiently fragmented tissue cells.

This degree of cell injury is produced by staphylococcal toxin; and as a side issue it reveals the true meaning of the terms "bound" and "free" histamine, or at least of the evidence upon which these terms were based.

For our line of reasoning it was significant that those samples which contained free histamine in solution also had slow stimulating action on the gut, whereas the apparently milder form of injury in which the histamine remained in the cell debris was not associated with the appearance of the slowly contracting substance.[3] There is, therefore, after toxin, an association between the liberation of histamine and the appearance of the slowly contracting substance in the perfusate; and in this respect our experiments on toxin agree with those on snake venoms.

Further agreement was afforded by the fact that alcoholic extracts from perfused monkey's liver into which toxin had been injected contained some slowly contracting substance which was absent from extracts of normal liver. We have not been able to provide decisive evidence for the formation by the toxin of lipin-split products with hæmolytic activity, but have been able to show only that extracts of intoxicated liver have rather less anti-hæmolytic activity than those of normal liver. If lipin cleavage products with hæmolytic activity are formed, they must be so feeble as to be masked by the antihæmolytic substances normally present in alcoholic extracts of liver.

The story which I have here unfolded makes clear the mode of action of a large group of cell-injurious agents, the snake venoms, and suggests a somewhat similar action for a bacterial toxin; but it has, I believe, a wider significance. How far this mechanism will be found to apply in other forms of cell injury can be determined only by detailed examination of each individual case; but with each fresh study some further detail is likely to come to light.

It is certain that the liberation of histamine and the formation of lysocithin are only part of what happens when cells are injured. Valy Menkin has isolated from inflammatory exudates an active substance, probably a fairly simple polypeptide, which not only causes local vasodilatation and increase in the permeability of the capillaries, but also determines migration of phagocytes to the site of inflammation.

The rôle of the cell laboratory in forming active chemical agents is every day becoming more important. The formation of active protein and lipin-split products probably accounts for the morbid changes in the injured cell itself, and plays a part both directly and indirectly in causing, in vertebrate organisms, the complex vascular response to injury. A polypeptide formed in, or liberated by, the injured cell accounts for the behaviour of the phagocytes; and it is likely that some other active agents liberated from the injured or dying cell will be found to provide the stimulus which leads to the formation of new tissue to replace what has been lost by injury.

MEDICO-LEGAL RISKS IN MEDICAL PRACTICE.[1]

By D. MURRAY MORTON, M.D.,
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AT the outset, I should like you to observe that I have varied the title of this address (it was originally announced as "Medico-Legal Risks in Surgical Practice"), for the reason that it is not the surgeon alone who constantly incurs the risk of litigation arising out of his practice; the physician is by no means immune, and the

[1] Read at a meeting of the Victorian Branch of the British Medical Association on June 1, 1938.

radiologist is especially vulnerable. Consequently I prefer the term "medical practice" used in its widest sense. Hence there is no justification for the refusal of certain physicians to join the Medical Defence Association on the ground that they see no reason why they should subscribe two guineas a year to pay for the mistakes of young surgeons. The accident of losing a needle in the pleural cavity is by no means rare; and in 1930, in New South Wales, a country practitioner, who unfortunately broke his needle during exploratory puncture, was penalized to the extent of £100 in damages and costs, in spite of the associated procedure of operating for empyema having admittedly saved the patient's life. I am acquainted with two cases in which this accident has happened to specialist physicians amongst us. They have been fortunate so far in escaping any legal consequences of their misadventures.

You have recently received a leaflet from the Victorian Branch of the British Medical Association on the necessity for medical defence. A list of selected typical claims over the last few years was included, totalling somewhat over £40,000. Of these, claims in cases which were definitely non-surgical totalled £20,000. The remainder were claims which, although in surgical cases, were made almost without exception against general practitioners.

Do you realize how unpopular is the profession to which we belong? We occupy a peculiar position in the community. We are trained for our profession in a semi-State institution which exacts a long and costly period of education. Finally, having produced evidence of adequate qualification, we are placed upon a State register. Thereafter we have the privileges of signing death certificates and of suing retrospectively for fees for services rendered. Otherwise we enjoy no more privileges or protection in pursuit of our living than any lay person.

You are forbidden to change the washer on a leaky tap—you must call in a licensed plumber. Now it is illegal for any person other than a trained and registered hairdresser to cut your hair; but it is perfectly legal for any person, however ignorant, to treat other persons for disease and to charge for his services. Moreover, the advertising columns of the Press are open for the publication of the most astounding claims by quacks. I am reliably informed that a full-page advertisement in one issue of one of our daily papers costs £140; yet periodically we read such an advertisement of the claims and achievements of a so-called rejuvenator. Although we have a *Venereal Diseases Act*, you may read advertisements in the daily Press in which Chinese undertake to forward by post herbal remedies for "acquired diseases". If we were not so destitute of popular esteem and political influence, we might aspire to be placed on the same footing as the plumber, the electrician or the hairdresser; but such an aspiration is Utopian.

The practical application of these preliminary observations lies in the present legal procedure when claims against medical men by dissatisfied patients come before the courts. Claims for damages come under the Common Law, which gives the plaintiff the right to have his case tried before a jury. Nowadays even the unprejudiced juryman assumes that there is an insurance corporation of some sort at the back of the defendant medical man, as there is usually in other actions for bodily damage. Others may be prejudiced (perhaps as good friendly society members) against what they consider to be that grasping and unscrupulous body, the British Medical Association. I have already quoted elsewhere the case in which a practitioner was sued for £10,000; it was revealed later that in the juryroom a juryman said: "Let us give the plaintiff £5,000; the B.M.A. will pay it." And they gave him £5,000.

Through the medium of the Medico-Legal Society we were afforded an opportunity in 1936 of bringing before some influential members of the legal profession the hardships of the medical profession under the present legal procedure. Subsequently the judges of the Supreme Court of Victoria drafted a new set of rules of procedure, which provided for such actions as those against medical men for bodily damage to be tried by a judge without a jury, unless the plaintiff could show good cause for a hearing before a jury. After the observance of certain prescribed formalities these rules were actually gazetted, and normally would have become operative on April 1, 1938. The new procedure would have suited us admirably, inasmuch as we should have been delivered from the routine of jury trials in medical cases. Unfortunately, owing to a vigorous protest from the Bar Committee, no doubt composed in part of die-hard jury-counsel, the Government intervened; and by an Order-in-Council, the operation of the new rules has been suspended until consideration by Parliament at its next session. There is serious danger that the outside influences which prevailed on the Government to obtain the suspension will also cause Parliament to veto the new rules altogether. Consequently, medical defendants will still be left to the tender mercies of ignorant and prejudiced juries; and more or less unscrupulous legal practitioners will continue to promote actions for damages for large amounts (the fashionable one is £5,000), relying on the knowledge that once a case of this kind reaches a jury, it is already half won by the aggrieved patient.

To illustrate how much it would mean to medical defendants if juries were eliminated in these cases, I may quote the case of Mackellar *versus* Allport, tried in Sydney in 1931. The plaintiff had sustained a fracture of the lower end of the tibia involving the ankle joint, and being dissatisfied with the result of treatment, he sued his attendant, a country practitioner, for £2,500. There was no evidence whatever of laxity in the conduct of the case, and a number of specialist surgeons testified that the result was the best possible one in an injury of that type. Nevertheless, the jury awarded £925 damages. After the jury had delivered its verdict, the presiding judge, Mr. Justice Halse Rogers, said: "I may say that,

if it is any satisfaction to the doctor in regard to his professional reputation, I would have come to a different conclusion if I were trying the case."

Of course, many claims are made for large amounts which do not come to a hearing in the courts. The policy of the legal advisers to claimants seems to be to aim high. Some of these claims are abandoned, and others are settled by the payment of comparatively small sums. Some claims so obviously approach blackmail that it is with the utmost reluctance that the Council of the Medical Defence Association agrees to a settlement of any sort. However, it is usually expedient to compromise even in such cases in order to avoid publicity and save expense. One successful action with the inevitable publicity is sure to bring a crop of other claims in its wake.

The nature of the medical practitioner's calling makes him peculiarly vulnerable to dissatisfaction. In spite of the most painstaking and conscientious treatment, the result frequently falls short of the patient's expectations. The illness or accident may be the result of his own carelessness; and a claim against his unfortunate medical attendant may be his only hope of compensation. It may be that at the most the medical man in such a case could hope to obtain only a few guineas for his services; on the other hand, the dissatisfied patient, through his legal advisers, talks in thousands.

At the present time probably the most common cause of dissatisfaction arises from fracture cases. Although the Röntgen rays have been serviceable and profitable to the medical profession, they have also proved very remunerative to the legal profession. A fracture result that may be considered quite satisfactory from the point of view of function, may be made to appear to a jury, by counsel with an X ray negative in his hands, to be a terrible deformity.

Through the annual reports of the Medical Defence Association, members have been repeatedly exhorted to insist upon X ray examinations in every fracture case, particularly with fractures near joints. The progress of the case should be checked by further radiograms; and recently Dr. John Kennedy has urged the importance of a final radiogram at the conclusion of treatment. We have had at least one case of threatened action before the Medical Defence Association in which the attendant omitted to have an X ray examination of a fracture of the forearm in order to save the patient expense. With her threat to sue him for a substantial amount, much stress was laid on his omission to have X ray examinations of the part. A well-meant effort to save a patient the expense of a couple of guineas may easily cost the attendant several hundred pounds, and much worry and harmful publicity.

The most costly action against any medical man in this State was brought a few years ago. The defendant was a general practitioner in a country town, and damages were sought for severe tissue destruction of the forearms of a patient following treatment for psoriasis by X rays. The plaintiff claimed £10,000 damages, and £5,000 were awarded by a jury.

The extreme danger in the use of X rays and radium by general practitioners with limited experience requires special emphasis, and I am indebted to Dr. L. J. Clendinnen and Dr. H. F. Praagst for the sound advice contained in the immediately following paragraphs on this subject.

It is known that some firms, when endeavouring to sell a small X ray machine, claim that therapy can be carried out with it. This is a very risky procedure unless the medical attendant has had experience in X ray treatment. If treatment is attempted the skin dose should be determined accurately by a standardized dosimeter, and all factors should be accurately recorded. Even if distance, filter, milliampèrage and time remain constant, the dose may still be varied by voltage fluctuations, particularly in small towns at different times of day and night.

In diagnostic radiation the risks to the patient can be considered under two headings: (i) those due to accidental contact with any part of the high tension circuit; (ii) those due to an over-exposure to radiation.

To eliminate the risks included under the first heading it is essential that all overhead wires *et cetera*, be installed and maintained in a secure condition; and the possibility of sagging wires from the tube, on account of faulty spring-reels, should be avoided. The tube should always be kept at a distance from the patient, at least twice that of the equivalent spark-gap of the voltage being used.

Over-exposure to radiation results most commonly from prolonged screen examinations, particularly the localization of foreign bodies and their removal under screen control, and the setting of fractures. Cases of radio-dermatitis have occurred after opaque meal and clysma examinations; and in this type of examination the patient is exposed to radiation from both fluoroscopy and radiography.

It must be realized that there is a skin tolerance dose which should be worked out for every machine under regular screen conditions. The exposure should always be kept well within this safety margin. A filter of one millimetre of aluminium should be permanently placed between the tube and the patient. This appreciably increases tolerance time. A cumulative timing device can be incorporated which will automatically indicate when the safety limit has been reached.

The screen current and field of exposure should be kept as small as possible, and the importance of the adequate adaptation of the examiner's eyes cannot be too strongly emphasized. It usually requires ten to fifteen minutes in a dark room to prepare the eyes thoroughly.

Treatment by radium by the inexperienced is really asking for trouble.

One case is known in Melbourne in which a general practitioner, after removing a breast, hired five radium needles from an X ray firm. He had read of cases in which needles were left in for seven days; so he played safe, as he thought, by taking them out in six days. The needles were fifteen times stronger than normal, the filtration was about one-fifth of the normal platinum, and the

full dose for these needles was nine hours. The woman carried five deep, unhealed ulcers for more than a year, with great suffering.

Medical men should be warned against referring to any X ray or radium reaction as a burn, which implies unintentional overdose. In many deep-seated growths results can be obtained only by deliberate blistering of the skin, which often takes weeks to heal.

The danger in treatment by diathermy of producing burns should also be borne in mind. One such case has been handled by the Medical Defence Association.

When discussing the legal disabilities of the medical profession with lawyer friends, we are frequently told that most of our legal troubles are attributable to members of our own profession. When this reminder is given to us, we are usually reduced to silence, because it is true to a large extent. Unhappily, there are medical practitioners with whom the defaming of their colleagues is part of their stock-in-trade, their motive being to demonstrate the inferiority to themselves of a previous attendant. With others to whom this practice is not habitual, temporary pique, resentment or jealousy may be the cause of some statement or action which will involve a colleague in the toils of the law.

An eminent surgical colleague told me that he once settled a claim for having unfortunately left a strip of gauze in a wound at operation. The patient having returned to the country with the wound still unhealed, the local practitioner eventually discovered the gauze in the sinus, and while slowly and gleefully extracting the gauze in view of the patient and his wife, exclaimed: "Now see what you get for going down to Collins Street!"

Even if we leave these extreme instances aside, much trouble may be caused by an unguarded remark. It is important, therefore, that we should constantly bear in mind the Golden Rule, because no one of us is infallible or impeccable, and the positions may be reversed any day.

When complaint as to his treatment is first made by a patient, it almost invariably takes the form of a letter from the patient to his attendant. I cannot impress upon you too strongly the unwisdom of replying to such a letter without first obtaining legal advice. If you are a member of the Medical Defence Association, as every sane practitioner is, the letter should be sent on at once to the secretary of the Medical Defence Association.

As an instance of how not to do it, a country practitioner recently sent us his dissatisfied patient's letter and a copy of his reply in which he said: "I am sending on your letter to the Medical Defence Association."

He probably thought that the patient would be overawed; on the contrary he was simply informing him that he was a member of a corporation presumably with ample funds to pay heavy damages. It is of the utmost importance not to mention the name of the Medical Defence Association.

At this stage, before the patient has employed a solicitor, the prospect of a favourable settlement is at its best. The council of the Medical Defence Association, through its solicitor, will advise the best form which the reply should take, and it will be so worded as to be most innocuous if later produced in court.

I may quote a case in which a patient had suffered severe and permanent disability as the result of a surgical accident, for which the operator, highly skilled and experienced, could not be held scientifically censurable. The surgeon was wise enough to bring the patient's letter to us at once. As no solicitor had yet been consulted by the patient, and as the patient was still well disposed towards the surgeon, we advised that the surgeon personally should make the best settlement he could with the least possible delay. The affair was amicably settled on the same evening by the payment of a comparatively small sum. Had the patient obtained legal advice there is no doubt whatever that the case would have cost thousands.

The person next to a solicitor most to be feared in these cases is woman!

Many years ago I had the doubtful pleasure of paying a patient £300 for a small strip of gauze unfortunately left in the wound after a nephro-lithotomy. The patient suffered only the inconvenience of a sinus until an up-country practitioner extracted the gauze. Three months after operation the patient came to me with the gauze and suggested compensation. He was an easy-going, amiable countryman, but unfortunately his wife accompanied him. It was she who drove the bargain; and I am sure that had I had to deal with the husband alone, the compensation would have been less than half.

If at all possible, keep women as well as lawyers out of these negotiations. "The female of the species is more deadly than the male."

It is fortunate, as it is probably remarkable, that the notoriously bad handwriting of medical practitioners is rarely the cause of misadventure giving rise to legal consequences. Legibility of the prescription and concentration in its writing should always be observed. It s highly dangerous to carry on a conversation with a patient when prescribing toxic drugs.

A few years ago a claim for damages was made by an elderly woman for overdosage with "Luminal". The patient had received her prescription, already crowded with the worst writing in the best tradition of the profession, so to speak. As she was leaving the room, as an afterthought, she informed her medical attendant that she was sleeping badly. He took back the prescription and in the corner prescribed a "Luminal" mixture in repeated doses of 0·02 gramme (one-third of a grain). Unfortunately the figures coincided with his printed address, and the chemist dispensed 0·19 gramme (three grains) of "Luminal". The patient, feeling rather upset after a few doses of her medicine, called in another attendant. His unwise criticism of the prescription led to a threat of action for heavy damages (£3,000). The patient could not possibly have sustained serious damage by the mistake, but the practitioner concerned preferred to settle independently of the Medical Defence Association in order to end the worry and strain of a threatened action. That experience cost him £200; and it still rankles.

In the law there is what is known as the Statute of Limitations, which debars an aggrieved person from initiating litigation six years after the cause of action. This is a reasonable and consoling safeguard. What one of us could sleep soundly at night if all our past mistakes could come, like the chickens, home to roost? However, it is not an absolute safeguard, as another aspect of the law may intrude as in the following remarkable case.

In 1932 a practitioner in a large country town, a member of the Medical Defence Association, was threatened with an action for damages in the following circumstances. Fourteen years previously he was performing circumcision on a male infant, when a failure of the electric light caused the operation to be completed by candle-light. Apparently a deep incision was inadvertently made in the *glans penis*. With the arrival of puberty and the occurrence of erection, the organ assumed a forbidding appearance. The cause of action having arisen before the practitioner had joined the Medical Defence Association, no assistance from the association was possible. I understand that the misadventure cost the surgeon £500; and from what I learned about the condition, any surgeon would have restored the organ to its normal condition for twenty guineas or so. The unhappy practitioner was in this position: having operated on the child at the age of one year, he was liable to be sued until the patient reached the age of twenty-one and for six years thereafter, the Statute of Limitations not beginning to take effect until the patient became of age. Consequently that particular sword of Damocles would have been suspended over his head for twenty-six years.

The general practitioner who regards as a perquisite the routine circumcision of all male infants born under his care may well ponder over the implications of this case.

No medical practitioner ever performs the always painful duty of certifying a patient as of unsound mind without a deep sense of responsibility as well as regret. Threatened litigation arising out of these certifications may cause great and protracted anxiety, because no person is so litigious as an individual with a kink. Unfortunately there is in our midst a pseudo-philanthropic society of recent growth called "The Society for the Protection of the Insane", one of whose functions seems to be to foment the resentment these unfortunate patients are apt to feel against those responsible for their segregation. The mere existence of a body of such an inquisitorial nature is an additional reason for the exercise of great care in certification and of exactness in specifying the grounds upon which the diagnosis is made. Further, for your own better protection it is advisable, if possible, to call in an expert alienist whenever certification appears to be necessary. By so doing you will be best consulting both the patient's welfare and your own legal protection.

In 1930 two suburban doctors were sued for £3,000 damages by a patient whom they had certified as insane in 1927. The case came to trial, which lasted several days, and was dismissed. An appeal was then lodged with the High Court, only to meet with the same result. This case was very costly to the Medical Defence Association; and the law expenses account in the year's balance sheet was shown as £620. Only one of these defendants was fortunate enough to be a member of the Medical Defence Association; consequently the litigation must have been very costly to his colleague. There is little doubt that the influence of the society before referred to was at the back of this case.

Medication by hypodermic and intravenous injections has now become so commonplace that it may surprise many of you that such a simple procedure carries a wide medico-legal risk. So many of such cases have come before the Medical Defence Association during recent years that only a brief reference is possible.

In 1930 a claim for £3,000 damages was made against a member of the association for a chronic skin affection alleged to be the result of injections of "Salvarsan" in the treatment of syphilis five years previously. Although the legal advisers of the Medical Defence Association considered that this claim could have been successfully resisted in court, the member preferred to settle the case at his own expense.

In 1936 a writ was issued against a member of the Medical Defence Association claiming £5,000 damages for an unfavourable result of treatment of hæmorrhoids by injection. The claimant in this case lived abroad, and the necessity for his early departure from Australia was a factor in the abandonment of this action.

In 1935 a claim against a medical man for unpleasant sequelæ to injection for varicose veins was promptly settled by payment by the Medical Defence Association of the mere expense involved in the treatment necessary for the complications.

Other cases involving threats of legal action have arisen from therapeutic injections for arthritis and from diagnostic injections in radiography.

It has been assumed in the past that the medical practitioner was weighted with more than his own personal responsibility to patients; it seemed that he had a legal liability for damage inflicted by the carelessness of nurses to patients under his care, even although the patient may have been an inmate of a public hospital. An address to the Medico-Legal Society delivered by Mr. Justice Lowe during this year has reassured us substantially on this point. The present trend of the law seems to be to regard the legal responsibility of a nurse as a personal one. Apparently no case has arisen in Australia involving this point. When it does arise, there is reasonable hope that a court may recognize also that there is a corporate responsibility of the hospital, public or private, and that a medical practitioner cannot be held liable for the misdeeds of an untrained and inexperienced nurse.

A case illustrative of institutional corporate liability is quoted in Kitchin's "Legal Problems in Medical Practice".

In England, in 1935, a local authority which maintained a maternity home was held liable for the negligence of its matron in failing to warn an incoming patient that a case of puerperal fever had just occurred in the home. The plaintiff and four other patients who shared a ward all caught the infection. The jury awarded £750 damages against the municipality.

It is well to remind you that there is such a thing in the law as a joint liability. In such a case as that just quoted, if a practitioner sent a patient to a hospital where he was aware that puerperal infection had arisen, and if his patient contracted the infection, there is little doubt that heavy damages would be awarded against him also.

Another obstetric risk has been pointed out recently by Dr. Winter Ashton in an address to the Victorian Branch of the British Medical Association. Although the matter was referred to at length in the last annual report of the Medical Defence Association, its repetition will still be profitable, as the following is a legal opinion obtained from the association's solicitor at the request of the Branch:

A doctor engaged to attend a confinement has no right to surrender the conduct of the case to a nurse without the knowledge and consent of the patient, and such consent should, if possible, be in writing or otherwise capable of proof.

If the case were surrendered without the knowledge and consent of the patient the doctor would be liable if there were any injury to the patient or child and if such injury could be attributed to the fact of the case having been surrendered or to negligence.

The doctor would be absolved from liability so long as he could prove the knowledge and consent of the patient, but we think the doctor should in such a case be able to show that the patient was aware that the nurse was a trainee (if such was the case); in other words, the doctor should advise the patient of the possible risk (if any) involved in surrendering the case.

If the case were surrendered either with or without the knowledge and consent of the patient, we do not think the doctor would have any claim for a fee for the confinement. We also think it advisable where the patient is a married woman to obtain the husband's consent as well as the wife's consent in the cases above mentioned, and more especially if the husband has engaged the doctor to attend the case.

In conclusion, it is to be hoped that you realize that, from the nature of your calling, you are all open to claims for grievances, real or imaginary, expressed in terms of thousands of pounds. Under the present rules of legal procedure such claims will be tried in court by juries devoid of all medical knowledge, with sympathetic leanings towards a disabled person, possibly prejudiced against our profession, and almost certainly convinced that an insurance corporation of some sort is at the back of the medical defendants. With these handicaps it is not surprising that every effort is made to keep these cases out of court, and on occasions it is even expedient to submit to a more or less blackmailing settlement.

I take it that every one of you has his home fully insured against fire. I have not yet heard of a medical man whose house has been burned down; but from my now lengthy experience of the Medical Defence Association and the constant succession of legal troubles arising amongst its members, I can assure you that the risk which you so carefully guard against by fire insurance is infinitesimal compared with the risk you run in your daily practice. Moreover, when you compare the amount you pay yearly for protection against fire with the very moderate subscription of two guineas for medical defence, you will be as surprised as we are that less than half of the registered practitioners of this State are members of the Medical Defence Association of Victoria. Even a layman, D. Harcourt Kitchen, barrister-at-law, in his "Legal Problems in Medical Practice", makes the following statement:

> How in the face of these considerations, which can hardly be new to any medical man, there still remain any practitioners who are not members of one of the large protection societies it is impossible to conceive. If a member of one of these bodies is threatened with proceedings . . . . he has only to fall back on the powerful aid of the society which employs legal advisers specially skilled in all the law relating to medical practice. Moreover, very many plaintiffs think better of bringing an ill-founded action against a doctor when they find that he is being supported by a strong protection society which is determined to fight the case.

Appendix.

Proposed Amendment to the Lunacy Act, 1928, of Victoria.

To follow Section 255.—2. No proceedings civil or criminal shall lie against any medical practitioner for or on account of any act matter or thing whatsoever done or to be done by him in pursuance or execution or intended or contemplated execution of any of the provisions of the Lunacy Acts or in respect of any alleged neglect or default in the execution or intended or contemplated execution of any such provisions whether on the ground of want of jurisdiction or on any other ground if such medical practitioner has acted in good faith and with reasonable care and no such proceeding shall lie or be instituted unless it is commenced within twelve months next after the act neglect or default complained of or within twelve months after the discharge under the Lunacy Acts of the party bringing the action.

3. If any such civil or criminal proceedings shall be taken by any person against a medical practitioner such proceedings may upon summary application to the Supreme Court or a Judge thereof be stayed upon such terms as to costs and otherwise as the Court or a Judge may think fit if the Court or Judge is satisfied that there is no reasonable ground for alleging want of good faith or reasonable care.

Discussion.

Attention may be called to the two methods of certifying patients under the *Lunacy Act*.

One method is for two medical men to certify a patient as insane, in which case it is necessary to sign the form given in the fifth schedule to the Act. This form requires the certifying medical men to state the facts on which they base their conclusions that the patient is insane, and on such certification a patient can be committed to a public or private mental home.

The other method is to certify the patient as apparently insane and recommend his admission to a receiving house for observation. In this case it is necessary to sign the form given in the Fifteenth Schedule to the Act. This form also requires the certifying medical men to state the facts on which they base their conclusions, and on such certification a patient can be committed to a Government receiving house for observation. In Victoria there are no private receiving houses and only two Government receiving houses, one at Melbourne and one at Ballarat.

The relatives of the patient may object to the patient's being sent to a Government receiving house. In this case the patient can be committed to a receiving house, and then, on the certificate of the superintendent, transferred to a private mental home. As an alternative the patient can be sent to a private mental home as a voluntary boarder, but this may not often be practicable.

A CRITICAL SURVEY OF RENAL FUNCTION TESTS IN THEIR APPLICATION TO THE DETERMINATION OF RENAL EFFICIENCY IN TOXÆMIAS OF PREGNANCY.

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Introduction.

DURING recent years many tests have been advocated as the ideal method for assessing renal function without adequate comparison of these new tests with those which have yielded useful information in the past. A bias has also existed in the use of one type of test in certain countries irrespective of the merits of the test. Thus MacLean's urea concentration test, found useful in British countries,

is seldom mentioned in American medical literature. It is therefore frequently difficult to compare observations from different writers in a given clinical condition such as the toxæmias of pregnancy.

Fowweather[1] stresses the value of reliable tests for renal function in establishing a clear diagnosis in chronic nephritis in cases in which the symptoms are inadequate, and also in indicating the degree of renal impairment where symptoms and physical signs are not always reliable. Such considerations are of the utmost importance in pregnancy, in which apparently mild toxæmia may have a fatal termination, or severe or prolonged toxæmia may cause such damage to the kidney that the patient is thenceforward a subject of chronic nephritis. The value of any test, or set of tests, capable of reliably indicating the presence of renal inefficiency, so that steps may be taken to prevent permanent damage, is apparent.

Few correlations of various renal function tests have been carried out in pregnancy. An attempt has therefore been made to determine the value of the urea concentration factor, the Van Slyke urea clearance test, the Rabinowitch urea concentration factor and the Fowweather urea clearance test, by comparison with the MacLean urea concentration test, which has proved useful in the past in determining renal function in normal and toxæmic pregnant women.

Cope[2] has indicated that the various tests may be used for the estimation of the efficiency of different functions, that some functions may be more affected by the nephritic process, and that certain tests may be of greater importance in providing information on which to base diagnosis or prognosis. A test should therefore be required only to estimate reliably the particular function with which it is concerned. The criteria for judging whether this condition is fulfilled are difficult to obtain, and Cope holds that since many functions of the kidney may not be equally depressed by a given renal lesion, divergence in results between two tests cannot be taken as evidence that either one is yielding fallacious information. If the results of two or more tests indicate an equal degree of inefficiency in the nephritic kidney, the conclusion may be drawn that they provide a reliable means of estimating the efficiency of the kidney in respect to the functions with which they deal. This method of approach has been applied in the present study.

Collection of Specimens for Biochemical Tests.

Since kidney function in pregnancy is subject to great variation due to fluctuations in severity of toxæmia or response to treatment, it was necessary to obtain the specimens for all the tests under identical conditions and on the same day. The following routine was adopted:

The patient was given no food or fluid after 12 midnight on the day preceding the test. At 4 a.m. the bladder was emptied; in many cases the patient was catheterized. Urine was collected at 5 a.m. (*A*), and the blood was drawn for estimation of the blood urea content (number I). At 6 a.m. a second specimen of urine (*B*) was obtained, and then 15 grammes of urea in 100 cubic centimetres of water were given. Urine was collected at 7 a.m., 8 a.m. and 9 a.m. Blood was also drawn at 8 a.m. (number II). From these specimens the data for the set of tests being investigated could be obtained. The Van Slyke urea clearance was calculated from samples of urine *A* and *B* and the blood urea content of sample number I of blood. The urea concentration test was determined from urine taken at 7 a.m., 8 a.m. and 9 a.m., and these were always considered in relation to blood urea number I. The Fowweather urea clearance and the Rabinowitch urea concentration factor were calculated from urine collected at 8 a.m. and blood urea number II.

Biochemical Methods for the Determination of the Urea Content of Blood and Urine.

The urea concentration in the blood was estimated by the MacLean urease and aeration method[3] and the concentration of urea in the urine by Dupré's method.[4] The slight inaccuracy in this latter method due to the estimation of nitrogen from all "NH_2" groups was fully recognized; but the method was deliberately chosen because it provided a simple, rapid method of estimation necessary in the routine of general hospital practice.

Summary of the Renal Function Tests under Discussion.

The MacLean urea concentration test,[5] was interpreted in terms of the urea concentrating power in association with volume and the total excretion of urea per three hours. Because of this modification in interpretation of the MacLean urea concentration test it will be referred to as the urea concentration-excretion test. This interpretation[6] may be summarized as follows:

Normal renal function is indicated when a normal percentage of urea is excreted in a normal or large volume of urine, so that there is a normal or a large total excretion of urea in three hours. Renal damage is indicated when: (i) a low percentage of urea is excreted in a small or normal volume of urine, resulting in a low total excretion of urea in three hours; (ii) a low percentage urea is excreted in a large volume of urine, but the total excretion of urea in three hours is low; (iii) a normal percentage of urea is excreted in a small volume of urine so that the total excretion of urea in three hours is low; (iv) in one specimen of urine the percentage of urea is normal or even high, but is excreted in a small volume of urine, the concentrations of urea in the other two samples being low, so that the total excretion of urea in three hours is low.

When the percentage of urea is low, but is excreted in a large volume of urine so that the total excretion of urea is normal or high, then the interpretation is uncertain.

The Van Slyke urea clearance was calculated as a percentage of the average normal function from urine *A* and blood urea number I, and from urine *B* and blood urea number I.

The urea concentration factor[8] is the ratio of urea in 100 cubic centimetres of urine to urea in 100 cubic centimetres of blood when samples of blood and urine are obtained simultaneously. Two values were calculated, one from urine *A* and blood urea number I, and the other from urine *B* and blood urea number I.

The Rabinowitch urea concentration factor[9] is the ratio of the urea in 100 cubic centimetres of urine to the urea in 100 cubic centimetres of blood, both specimens being taken two hours after the ingestion of 15 grammes of urea.

The Fowweather urea clearance is a modification of the Van Slyke clearance and is calculated on urine, taken at the end of the second hour after the ingestion of 15 grammes of urea, and the urea content of blood taken at the same time.

Analysis of Experimental Data Obtained in a Series of Normal and Toxæmic Pregnant Women.

The Van Slyke Urea Clearance Test.

Van Slyke has stated that the chief source of error in the urea clearance test is incomplete emptying of the bladder, and that it may be eliminated by calculating clearances on two consecutive samples of urine and averaging the results.

In a series of 442 Van Slyke tests the variations between the two values were so great in many instances that it was questionable whether such an average was significant. There were 88 tests in which clearances calculated on urine specimens *A* and *B* disagreed in such a way as to confuse the results, the finding in one test being greater and in the other less than 70% of the average normal function.

In 99 of these 442 tests the percentage of urea and the volume of urine were greater in urine *A* than in urine *B*, and in 33 tests in this group one value was less and one greater than the normal 70%. In these cases it was difficult to determine the state of functional activity of the kidney. In 13 of these 99 tests, both values were less than 70% and in 53 both values were greater than 70%, hence no confusion arose. The effects observed, leading to discrepancy in one-third of the tests of this type, were probably due to incomplete emptying of the bladder prior to the commencement of the test and inclusion of some of the more concentrated night urine in specimen *A*. Thirteen patients were submitted to Van Slyke clearance tests in which all specimens of urine were obtained by catheterization. The differences between the percentages of the average normal function estimated from specimen *A* and specimen *B* varied from −2·6% to +94%. There was, however, only one case in which one value was less and one greater than 70%. Fewer conflicting results might occur if all specimens of urine were obtained by catheterization; but such procedure is difficult in public hospital routine.

In other tests in which *A* and *B* values disagreed the average might reasonably be used as an indication of renal efficiency, for example: (i) when the percentage of urea was higher but the volume of urine smaller in *B* than *A*; (ii) when the percentage of urea was lower but the volume greater in *B* than *A*; (iii) when the percentage of urea was identical in *A* and *B* but there was a greater volume of urine in *B*. It would seem in these latter cases that there had been incomplete emptying of the bladder in the first hour.

In a few instances the percentage of urea was identical in specimens *A* and *B*, but the volume of specimen *B* was smaller than *A*. In such cases the bladder may have been incompletely emptied in the second hour, and the clearance calculated on the first specimen would be more accurate. On the other hand, the discrepancy in volume might be due to inaccuracy in the time of collecting each specimen, and the averaged result would be more reliable. In other tests it was impossible to decide whether the results *A*, *B*, or the average should be used as the measure of renal efficiency: (i) when the volumes of *A* and *B* are equal but the percentage urea is higher in specimen *B*; (ii) when the volumes of *A* and *B* are equal but percentage urea is less in specimen *B*; (iii) when the volume of *B* and the percentage of urea in *B* are greater than the volume of *A* and the percentage of urea in *A*.

These variations between the values of *A* and *B* are also present in many cases in which both results are greater or less than 70% of the normal values, hence the average value cannot be taken as adequately representing the degree of renal efficiency.

The large number of tests in which discrepancy occurs between the *A* and *B* values due to incomplete emptying of the bladder, to slight inaccuracy in the time of collecting the specimens or to unexplainable factors affecting the kidney, make this test less reliable than is desirable in assessing renal function in pregnancy. These effects might be overcome by catheterization and very careful timing of collection of the specimens; but tests so sensitive to slight variations are unsatisfactory.

The Urea Concentration Factor.

In the test for the urea concentration factor, introduced by Gréhant, the ratio of urea in the urine to urea in the blood is calculated without consideration of the effect of the volume of the urine secreted. Harrison[11] indicated that consistent results were obtainable only when the volume of urine did not exceed 100 to 150 cubic centimetres per hour. Under such conditions Harrison considers the ratio to be one of the most sensitive and useful guides to the efficiency of renal function. Two values have been calculated for this test in this series of observations, one from urine *A* and blood urea number I and the second from urine *B* and blood urea number I. As in the Van Slyke test, there were considerable variations between the values. In 63 out of 442 tests one ratio was greater and the other less than the normal ratio of 70. The differences were due to varying concentrations of urea in the two specimens of urine, frequently, but not always, associated with variations in volume. Such variations in ratios calculated on the examination of consecutive specimens of urine cast grave doubt on the reliability of this test of renal function.

In a series of 285 tests of patients in the *ante partum* period, the urea concentration excretion test was compared with the Van Slyke urea clearance test and the urea concentration factor in normal, mildly toxæmic, and severely toxæmic pregnant patients (Table I). This comparison shows agreement between the results of the three tests in 40% of the tests in normal pregnancy and that the results of all tests indicated normal renal function. In mild toxæmias there was agreement between the results of the three tests in 29 of 98 cases, 20 tests indicating normal renal function. In severe toxæmias examina-

tion of 35 out of 113 patients gave similar results in the three tests; but 24 of these tests indicated renal inefficiency.

To compare the value of the five renal function tests already mentioned all tests were excluded from any patient when doubt existed as to the interpretation of the Van Slyke clearance test or the test for the urea concentration factor. In Table II the results of these five tests, namely, the urea concentration-excretion test, the Van Slyke urea clearance test, the test for the urea concentration factor, the test for the Rabinowitch factor, and the Fowweather urea clearance test, are compared in 187 cases of normal, mildly toxæmic and severely toxæmic pregnancy. The percentages of low values in the urea concentration-excretion test, the Van Slyke clearance test and the test for the urea concentration factor are very similar to those already found in the larger groups as shown in Table I. In the comparison of the results of the five tests it may be seeen that 14 out of 42 patients in normal pregnancy had normal renal efficiency as assessed by any of the five tests. In mild toxæmia six out of 21 tests where the five tests agreed indicated renal inefficiency. In 19 out of 26 cases in which there was agreement in the results of the five tests in severe toxæmia renal inefficiency was indicated.

From these results it is evident that agreement between the result of the urea concentration-excretion test, the Van Slyke clearance test and the test for the urea concentration factor and between these and the Rabinowitch factor and the Fowweather clearance occurs in only 33% of the cases studied.

In each of the types of patient being investigated the incidence of results indicating renal inefficiency is similar in the Van Slyke and Fowweather clearance tests and close agreement occurs between the urea concentration factor and the Rabinowitch factor. The urea concentration-excretion test occupies an intermediate position in normal pregnancy and mildly toxæmic pregnancy, but its results agree with the urea concentration factor and the Rabinowitch factor in the severe toxæmias.

Cope's hypothesis[2] that if the results of two or more tests agree in indicating an equal degree of inefficiency they can be taken as a reliable estimation of the function with which they deal is thus proved inadequate.

In this problem there are two possibilities: either the Fowweather clearance and the Van Slyke test are the more reliable measures of testing renal function, since they give the smallest number of results indicating renal inefficiency in the normal pregnant patients, or the urea concentration test, the Rabinowitch factor and the urea concentration-excretion test are more efficient tests of kidney function, since they are capable of detecting a smaller degree of renal inefficiency.

Since the Van Slyke clearance test and the test for the urea concentration factor yield doubtful results in so many cases they have been dismissed as unsatisfactory.

TABLE I.

A Comparison of the Van Slyke Urea Clearance Test, Urea Concentration Factor and the Urea Concentration Excretion Test in Normal, Mildly Toxæmic and Severely Toxæmic Women. (The total number of tests was 385.)

Type of Case.	Number of Cases.	Number in which the Blood Urea Content was Above 40 Milligrammes per centum.	Number of Cases with Values Indicating Renal Damage.			Three Tests.	
			Modified MacLean Test.	Van Slyke Test.	Urea Concentration Factor.	Each Normal.	Each Low.
I. Normal pregnancy	51	3	16	10	24	21	—
Normal pregnancy following toxæmic pregnancy	23	—	5+1 (?)	5	9	9	—
Total	74	3	21+1 (?) (28 to 30%)	15 (20%)	33 (45%)	30 (40%)	0 —
II. Mild toxæmia—							
a. Albuminuria up to four days' duration	34	—	16+2 (?)	12	25	8	6
b. Mild recurrent toxæmia	30	2	12+1 (?)	5	10	10	3
c. Pyelitis	34	2	14+5 (?)	9	16	2	0
Total	98	4	42+8 (?) (42 to 51%)	26 (27%)	51 (52%)	20 (20%)	9 (9%)
III. Severe toxæmia—							
a. Prolonged albuminuria	77	10	49+7 (?)	21	43	9	12
b. Severe albuminuria	36	10	26+4 (?)	22	26	2	12
Total	113	20	75+11 (?) (66 to 76%)	43 (39%)	69 (61%)	11 (10%)	24 (21%)

[NOTE.—(?) indicates large volumes and therefore uncertain interpretation.]

TABLE II.

A Comparison of the Van Slyke Urea Clearance Test, Urea Concentration Factor, Rabinowitch Urea Concentration Factor, Fowweather Urea Clearance and the modified MacLean Urea Concentration Test in Normal Pregnancy and Toxæmia of Pregnancy.

Type of Case.	Number of Cases.	Number of Cases with Blood Urea Content Above 40 Milligrammes *per centum*.	Number of Cases with Values Indicating Renal Damage.					Results of Five Tests.	
			Modified MacLean Test.	Van Slyke Test.	Urea Concentration Factor.	Rabinowitch Concentration Factor.	Fowweather Urea Clearance.	Normal.	Low.
I. Normal pregnancy	31	1	10	8	15	12	4	12	—
Normal pregnancy following toxæmic pregnancy	11	—	3+1 (?)	—	5	6	2	2	—
Total	42	1	13+1 (?) (31 to 34%)	8 (20%)	20 (49%)	18 (44%)	6 (15%)	14 (34%)	—
II. Mild toxæmias—									
a. Albuminuria up to four days	23	2	9+2 (?)	9	15	14	8	6	3
b. Mild recurrent toxæmia	18	—	5+1 (?)	2	5	8	3	7	3
c. Pyelitis	22	2	8+3 (?)	6	10	18	4	2	—
Total	63	4	22+6 (?) (35 to 44%)	17 (27%)	35 (56%)	40 (63%)	15 (24%)	15 (24%)	6 (10%)
								34%	
III. Severe toxæmias—									
a. Prolonged albuminuria	56	7	34+6 (?)	19	36	44	21	5	10
b. Severe albuminuria	27	7	19+4 (?)	15	18	21	13	2	9
Total	83	14	53+10 (?) (64 to 76%)	34 (46%)	54 (65%)	65 (78%)	34 (41%)	7 (8%)	19 (23%)
								31%	

[NOTE.—(?) indicates that the interpretation is uncertain.]

The Rabinowitch Urea Concentration Factor.

In order to determine whether any correlation existed between the response to the urea concentration-excretion test and the Rabinowitch factor, a distribution graph was constructed by plotting the total excretion of urea in three hours after the ingestion of urea, against the Rabinowitch factor in each of the three types of case studied. From Graph I it will be seen that only two in 51 tests fell inside the area bounded by Rabinowitch factor 50 and urea excretion 3·5 grammes per three hours. Each of these patients had previously suffered from toxæmia of prenancy, hence there might be a slight renal lesion. In 32 cases the results of both methods indicated renal efficiency, that is, there was agreement in 67% of cases. In six cases (upper left section of graph in Figure I), the urea excretion was low, while the Rabinowitch factor was normal; but in only three cases was the excretion less than 3·0 grammes per three hours.

In nine cases (lower right sections of graphs in Figure I) the Rabinowitch factor was low while the urea excretion was greater than 3·5 grammes per three hours. In only two was the urea excretion more than four grammes when the Rabinowitch factor was less than 40. Among the mild toxæmias 62% of results agreed in both methods, 27 indicating normal renal function and 12 inefficiency. In 10 cases the urea excretion was low when the Rabinowitch factor was normal (upper left sections of graphs in Figure I) and with one exception these were border-line cases. In 15 tests (lower right section of graph in Figure I) a low Rabinowitch factor occurred with a normal urea excretion per three hours. In six of these cases the Rabinowitch factor was less than 40. Among the severe toxæmias 55% of results agreed in both methods, 15 indicating normal function and 36 renal inefficiency. In 13 cases a low urea excretion occurred with a normal Rabinowitch factor (upper left section of graph in Figure I) and in ten of these the urea excretion was less than three grammes per three hours. There were 24 cases in which the urea excretion per three hours was normal, but the Rabinowitch factor was low (lower right section of graph in Figure I). In 14 of these the Rabinowitch factor was less than 40. Inspection of individual results where discrepancy between the results of the two tests occurred showed that when the volume of urine was small and there was consequently a high urea concentration, normal or high Rabinowitch factors resulted, and these were frequently at variance with the clinical evidence. Similarly low Rabinowitch factors were frequently associated with low concentrations of urea, secreted in a large volume of urine. In the latter instance the Rabinowitch factor may be fallacious; but the urea concentration-excretion test may be equally incorrect. In a few cases the low Rabinowitch factor was due to a raised blood urea content. Peters and Van Slyke[12] have shown that the results of MacLean's urea concentration test may indicate

normal renal function when the blood urea content is high, in spite of obvious renal damage. In such cases the Rabinowitch factor would be the more accurate measure of renal damage. Statistical analyses on the results of the tests in each of the three groups of patients showed that no correlation existed between the excretion of urea per three hours and the Rabinowitch factor in the normal pregnant group. Although each test on the same patient may indicate normal function, the degree of normality represented by each may be very different from the other. Among the mildly toxæmic patients and also among those with severe toxæmia a highly significant relationship existed

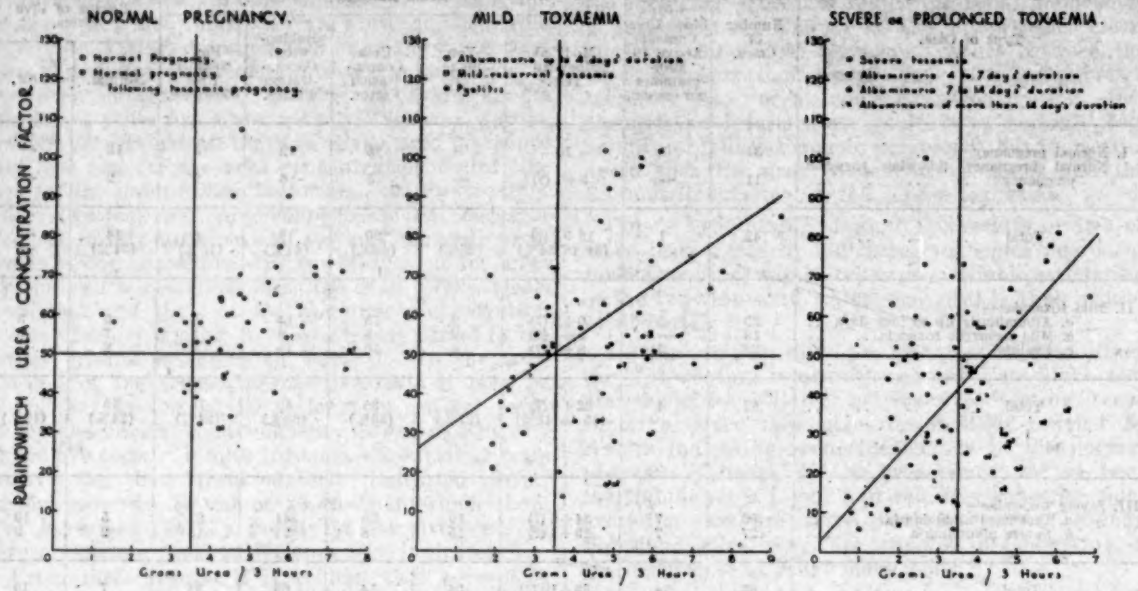

FIGURE I.
Graphs showing the Rabinowitch urea concentration factor and the results of the urea concentration-excretion test in normal pregnancy and in mild and severe toxæmias of pregnancy.

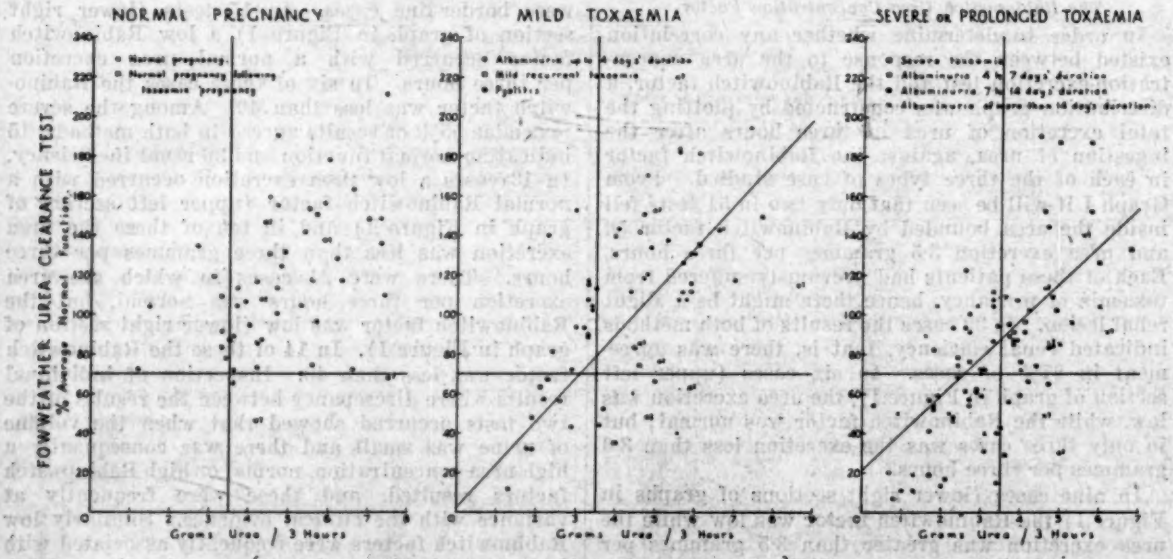

FIGURE II.
Graphs showing the results of the Fowweather clearance test and the urea concentration-excretion test in normal pregnancy and in mild and severe toxæmias of pregnancy.

between the responses to the two tests, even when those tests were included in which interpretation of the urea concentration-excretion was "uncertain" (represented by (?) on the graphs). Digression lines were calculated and are shown for these groups in Figure I.

The Fowweather Urea Clearance.

Agreement between the results of the Fowweather and the urea concentration-excretion tests occurred in 80% of cases in the normal pregnant group and all indicated normal renal function. In eight (upper left section of graph in Figure II) the Fowweather clearance was normal and the urea excretion per three hours was low, but was less than three grammes in three cases only. In two cases the figure for the Fowweather clearance was low, while the urea excretion per three hours was normal. In only one of these was there any pronounced disagreement.

There was agreement between the results of the two tests in 68% of the mild toxæmias, 35 indicating normal efficiency and nine renal inefficiency. In 13 tests the Fowweather clearance was normal and the urea excretion per three hours was low (left upper section of graph in Figure II); but in only three of these was the urea excretion less than three grammes. In six tests the Fowweather clearance was low when the urea excretion per three hours was normal (lower right section of graph in Figure II). In only two cases was the Fowweather clearance less than 50% when the urea excretion was at least four grammes. In the severe toxæmias both methods agreed in 71% of cases, the results of 32 tests indicating normal renal function and of 31 tests renal inefficiency. In 19 tests the Fowweather clearance was normal whilst the urea excretion was low (upper left section of graph in Figure II). In seven cases the excretion of urea was more than three grammes and in three the points fell close to the digression line. Thus in only nine cases was the discrepancy serious. Among the seven cases in which the Fowweather clearance was low but the urea concentration-excretion test normal, there was difficulty in assessing the renal function in three cases only.

These results were submitted to statistical analysis and, as in the comparison between the Rabinowitch factor and the response to the urea concentration-excretion test, no correlation existed between the responses to the Fowweather clearance test and the urea concentration-excretion test respectively, in the normal pregnant group. Although in 80% of cases both methods indicated normal renal function, the degree of efficiency assessed by the one method varied greatly from that obtained by the second method. A highly significant association was proved to exist between the Fowweather clearance test and the urea concentration-excretion test in the mild and severe toxæmias. Digression lines were calculated for both mild and severe toxæmias. These are indicated in Figure II. The lines are nearly identical for these two groups in Figure II, but diverge greatly in Figure I. This would seem to indicate a much closer association between the responses to the Fowweather clearance test and the urea concentration-excretion test, than between the latter and the Rabinowitch urea concentration factor.

In a search for the reason for the discrepancy between the responses to the urea concentration-excretion and Fowweather tests, a study of the hourly excretion of urea during the three hours following the ingestion of 15 grammes of urea showed that five types of curve could be differentiated: (i) where the urea excretion per hour was practically constant (Group I, Figure III); (ii) where the urea excretion was very low in the second hour and increased considerably in the third hour (Group II, Figure III); (iii) where the greatest excretion of urea occurred in the first hour (Group III, Figure III); (iv) where a pronounced rise in urea excretion occurred in the second hour and this rapidly decreased in the third hour (Group IV, Figure III); (v) where there was a small excretion of urea in the first hour and sometimes in the second hour also, and then a large increase in the

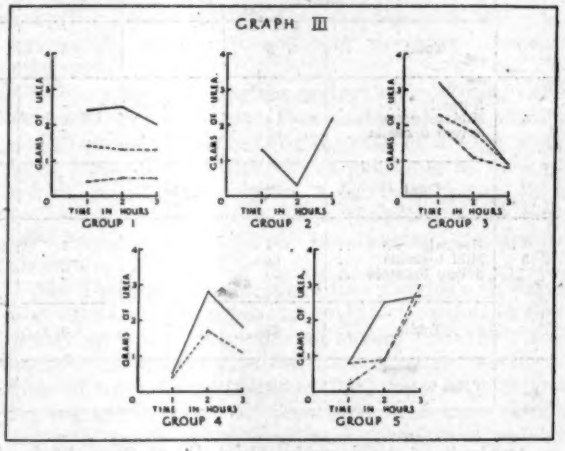

FIGURE III.

Graphs showing the five different types of results of the estimation of the amounts of urea excreted after the ingestion of fifteen grammes of urea.

third hour. The incidence of these types of curve in the results of tests on the 202 patients investigated and occurring in the different relationships between the urea concentration-excretion and Fowweather tests is set out in Table III.

Renal efficiency was shown in 93 cases and inefficiency in 43 cases by both tests; that is, there was agreement between the two methods in 67% of cases. In 25 of these cases, although the results of both tests were normal, the Fowweather figure was higher than would be expected from the urea concentration-excretion test, and in 30 cases the Fowweather figure was apparently too low. In addition, in 25% of cases the response to the urea concentration-excretion test indicated renal inefficiency, whilst the response to the Fowweather test was normal, and in a further 6% the result of the urea concentration-excretion test was normal but the Fowweather test indicated renal inefficiency.

TABLE III.

A Comparison of the Results of the Fowweather Clearance and the Urea Concentration-excretion Tests.

Group.	Type of Pregnancy.	Number of Cases.	Results of Both Tests Normal.	Results of Both Tests Low.	Results of Both Tests Normal.		Results of Both Tests Low.		Result of Urea Excretion-concentration Test Low; Fowweather Normal.	Result of Urea Excretion-concentration Test Normal; Fowweather Low.
					Fowweather Possibly Too High.	Fowweather Possibly Too Low.	Fowweather Possibly Too High.	Fowweather Possibly Too Low.		
1	Normal	32	12	—	6	6	—	—	8	—
	Mild toxæmia ..	29	8	4	5	1	3	—	8	—
	Severe toxæmia ..	43	5	10	2	4	2	7	12	1
	Total ..	104	25	14	13	11	5	7	28	1
2	Normal	5	2	—	—	—	—	—	—	3
	Mild toxæmia ..	5	1	1	1	—	—	—	—	2
	Severe toxæmia ..	6	2	1	—	1	—	—	—	2
	Total ..	16	5	2	1	1	—	—	—	7
3	Normal	3	2	—	1	—	—	—	—	—
	Mild toxæmia ..	2	1	—	1	—	—	—	—	—
	Severe toxæmia	3	—	2	—	—	—	—	—	—
	Total ..	8	3	2	2	—	—	—	—	—
4	Normal	7	5	—	—	—	—	—	2	—
	Mild toxæmia ..	15	5	1	4	1	—	—	4	—
	Severe toxæmia ..	17	6	2	—	1	—	—	8	—
	Total ..	39	16	3	4	2	—	—	14	—
5	Normal	4	1	1	—	—	—	—	1	1
	Mild toxæmia ..	11	3	—	—	2	—	1	3	2
	Severe toxæmia ..	20	4	2	—	—	—	6	6	2
	Total ..	35	8	3	—	2	—	7	10	5
	Total tests ..	202								

Analysis of the cases in which the figures obtained by the Fowweather test were higher than would be expected, including those cases in which results disagreed, showed the following:

(i) *Group I*: Forty-six, in 28 of which renal inefficiency was indicated by the urea concentration-excretion test and normal function by the Fowweather test.

(ii) *Group II*: One.

(iii) *Group III*: Two.

(iv) *Group IV*: Eighteen, in 14 of which inefficiency was indicated by the urea concentration-excretion test and normal function by the Fowweather test.

(v) *Group V*: Eleven, in each of which the urea concentration-excretion test indicated renal inefficiency and the Fowweather test normal function.

It was observed that in many cases in Group I in which the Fowweather value was apparently too high, the blood urea content after the ingestion of urea was less than 40 milligrammes per 100 cubic centimetres; in some cases the volume of urine in the second hour of the test was large, the volumes of urine throughout the test were large, and in some cases the volumes of urine were very small, while urea concentration was high. In Group V the low blood urea content after the ingestion of urea was again noted in seven out of eleven cases, and in others a sharp rise occurred in the excretion of urea in the second hour. In Group IV, in which a considerable rise in the excretion of urea occurred in the second hour, a higher Fowweather figure was to be expected.

The Fowweather value was lower than would be expected in 21% of tests, including 6% in which the response to the urea concentration-excretion test indicated normal function whereas the result of the Fowweather test indicated inefficiency. Analysis of the results showed the following:

(i) *Group I*: Nineteen tests were performed. In only one case was there discrepancy in the interpretation of kidney function.

(ii) *Group II*: Eight tests were performed. In seven cases the result of the Fowweather test indicated renal inefficiency.

(iii) *Group IV*: Two tests were done. In each case the results of both tests were normal; but the result of the Fowweather test was lower than would be expected.

(iv) *Group V*: Fourteen tests were performed. In five cases there was disagreement between the results of the urea concentration-excretion and Fowweather tests.

A high blood urea content after the ingestion of urea was noted in thirteen cases in Group I, in one case in Group II, and in seven cases in Group V. In several of these the blood urea content before the ingestion of urea was high; hence the Fowweather value is in these cases more likely to be the true measure of kidney function. In several instances the volumes of urine secreted were very large, and when this association of large volume and normal secretion of urea per three hours occurs, it has already been shown to be impossible to interpret the results in terms of kidney efficiency. When the urine is in large quantities it is frequently impossible to assess the renal function by either method. Because there is a pronounced decrease of urinary urea in the second hour after ingestion of urea the high incidence of low results to the Fowweather test in Group II is to be expected.

Discussion.

Van Slyke has pointed out that the main cause of inaccuracy in the urea clearance test is incomplete emptying of the bladder. It has been shown in this paper that great discrepancies frequently occur in this test between values calculated on consecutive hourly specimens of urine of pregnant women, and that these discrepancies are frequently due to variations in volume of the two specimens. In many instances these effects make the interpretation of the renal function impossible. Similar difficulty detracts from the reliability of the urea concentration factor. Hence these tests have been eliminated as methods for giving an accurate indication of renal function. Fowweather[1] modified the Van Slyke urea clearance test by performing it after the administration of urea; he was able greatly to limit the range of values for renal function in a series of fifty normal students. He explains the effect as being due to the action of the urea as a stimulus to the bladder to empty itself completely. Probably a more accurate explanation of this effect is that the diuretic action of the urea, causing secretion of a larger volume of urine, consequently greatly reduces the error due to incomplete emptying of the bladder. The Rabinowitch factor is a modification of the urea concentration factor, the result being calculated after the administration of urea. Although a significant association exists between the response to the urea concentration-excretion test and the Rabinowitch factor, variations from the normal volume of urine secreted in the second hour after ingestion of urea have a marked effect on the Rabinowitch factor. Thus when the urine is highly concentrated or very dilute, the Rabinowitch factor does not agree with urea concentration-excretion or with the clinical condition of the patient.

A significant relationship has been proved between the urea concentration-excretion and the Fowweather tests, and these methods agreed in their assessment of renal function in 67% of cases. The degree of renal efficiency assessed by one method is not invariably in accord with that found by the second method.

Great variations in volume and urea excretion in each of the three hours following ingestion of urea have a profound effect on the Fowweather value. From the clinical evidence available, decreased total excretion of urea seems to be definitely associated with renal inefficiency. Hence when a low urea concentration-excretion value is found in conjunction with a normal or high Fowweather value, the former is of greater significance.

When the blood urea content after the ingestion of urea is high, particularly if it was high before the urea, a low Fowweather value frequently occurs in association with a normal urea concentration-excretion, and in such cases the Fowweather value represents the more accurate measure of renal efficiency.

When a normal urea concentration-excretion value occurred with a low Fowweather value, which could not be accounted for because of a high blood urea content, no evidence was available to indicate which result was correct. In these cases it is evident that the tests must be repeated in the hope of obtaining conditions eliminating discordant factors.

The Fowweather clearance test provides an excellent check on the urea concentration-excretion test, involving only the determination of the urea content of blood drawn two hours after the ingestion of urea, in addition to the usual estimations. Agreement between the results of these tests would allow a much more dogmatic pronouncement on renal efficiency than could be made on the result of any single test.

The statement by Dieckmann,[9] that the MacLean urea concentration test was of little value for diagnosis or prognosis because of the low values of urinary urea in normal and toxæmic pregnant patients even after urea by mouth, is not supported by the results of the investigations here reported. It has been found that most normal pregnant women and many severely toxæmic pregnant women excrete at least four grammes of urea in three hours after the ingestion of fifteen grammes of urea. This test has proved to be the most accurate test for estimation of renal function in pregnancy, and its value is increased when the concentration and volume are taken into consideration, as in the urea concentration-excretion test. Correlation with the Fowweather urea clearance test further establishes the accuracy of this test. In a study on urea clearance in pregnancy Cantarow and Ricchiuti[13] stated that the response to the test, after being normal for the first few months, diminished as the pregnancy progressed, was rather consistently low a

few days before labour, and high again during the early days of the puerperal period. It would seem probable that insufficient patients had been tested in the early months of pregnancy to determine the ranges of clearance values at these times. Thus in the article quoted twenty-five patients were studied at nine months' gestation, whereas five was the highest number in any other group. In four cases two or more tests were taken during the pregnancy. In three of these the initial urea clearance was slightly less than 70%, indicating a mild renal inefficiency. Results of tests at nine months were still lower, and were interpreted as being due to the longer duration of the gestation period.

Since these patients were normal pregnant women, the effects of the lowered clearance cannot be said to be due to progression of a renal lesion, even though the original value was low. As Fowweather has shown that even in tests of normal students the Van Slyke clearance figures varied between 29% and 107% of the average normal function, the values obtained in these three instances may not represent renal damage, but may be due to the wide limits of normal values in this test.

A statistical analysis of the results reported in this paper of the urea concentration-excretion test, the test for the Rabinowitch factor, and the Fowweather clearance test, was made in the case of normal pregnant patients, patients with mild toxæmias of pregnancy and those with severe toxæmia, in order to determine whether the results varied with the length of the gestation period. The patients in each group, for each test, were classified: (i) as to the length of the pregnancy, (ii) as to whether the result of the test indicated normal function or renal inefficiency. The X^2 formula was applied to the figures so obtained in the study of each group of patients. The results showed that the discrepancy from independence between these two factors was less than would be expected to occur once in one hundred times by chance alone. Thus there is no association between the length of the pregnancy and the state of renal efficiency indicated by the test.

If, therefore, low values are obtained in the urea concentration-excretion and the Fowweather clearance tests, the kidney function is definitely impaired. The length of the period of gestation is not responsible for such results in the later weeks of pregnancy.

Conclusions.

The Van Slyke urea clearance test and the tests for the urea concentration factor and the Rabinowitch factor are not reliable methods for the estimation of renal function in pregnancy.

The urea concentration-excretion test and the Fowweather urea clearance test form an excellent combination for assessing renal function. The length of gestation period does not invalidate these tests as indications of renal inefficiency in the later months of pregnancy. Discrepancies between the results of the two methods do occur when there are pronounced irregularities in volume of urine or amount of urea excreted per hour after ingestion of urea. In such cases the indications of renal inefficiency provided by the urea concentration-excretion test are more likely to be correct than normal function indicated by the Fowweather test. If normal function is indicated by the urea concentration-excretion test and the blood urea content is high, a low Fowweather clearance is the more accurate measure of renal function.

Where there is pronounced diuresis, resulting in a normal urea concentration-excretion value and a low Fowweather value, either result may be misleading.

Summary.

1. The Van Slyke urea clearance test, the urea concentration factor, the Rabinowitch factor, and the Fowweather urea clearance test are compared with the urea excretion-concentration test (modified MacLean urea concentration test).

2. Discrepancies between Van Slyke clearances calculated on successive hourly samples of urine are discussed.

3. Similar variations in urea concentration factors calculated on successive hourly specimens of urine are recorded.

4. Statistical analysis shows that a significant relationship exists between the Rabinowitch factor and the response to the urea concentration-excretion test; but the tests disagreed in many cases. The Rabinowitch factor is incorrect when small volumes of urine with high concentration of urea, or large volumes of urine with low concentration of urea, occur.

5. A significant relationship exists between the response to the Fowweather urea clearance test and the response to the urea concentration-excretion test, agreement occurring in 67% of the tests performed.

Acknowledgements.

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TEMPERATURE AS A FACTOR TO BE CONSIDERED IN CLINICAL URINOMETRY.

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The Problem.

My attention was first drawn to this subject when I was consulted about a specimen of urine, the specific gravity of which was considerably less than 1,000. The subject who had passed this urine had been indulging in an alcoholic debauch of some magnitude and, as a consequence, could have been expected to be passing a dilute urine. But how less than 1,000?

Reflection led me to consider the temperature, as the shade temperature at the time was well over 37·8° C. (100° F.). It is a well-known fact of elementary physics that the specific gravity of pure water varies with the temperature, being greatest at 3·98° C. Below this critical temperature the specific gravity of water falls again, and this fact, because it means the cessation of convection currents at temperatures below 3·98° C., explains why, in cold climates, a pool or stream of water does not freeze solid. Reference to tables showing the relative density and volume of water revealed the fact that at 37° C. the density of pure water was 0·993 gramme per millilitre (Smithsonian tables), corresponding to 993 on the ordinary scale. It was at once obvious that here was a possible answer to the problem of a specimen of urine with a specific gravity of less than 1,000. This suggestion was further confirmed by cooling the urine to 15·6° C. (60° F.), when the specific gravity read just over 1,000.

Investigation.

With the idea of throwing further light on this matter, the specific gravity readings of the following were taken: commercial distilled water obtained from a local garage, a 2% solution of sodium chloride, an ordinary specimen of urine and a specimen of urine with 1·5% glucose added (sufficient to give a good reduction of Benedict's qualitative reagent). The various liquids were cooled from 43·3° C. (110° F.) to 4·4° C. (40° F.), the specific gravity being taken after every fall of 5·5° C. (10° F.).

The instruments used to take the specific gravity measurements were three: two clinical urinometers, one bearing the label "Urinometer Tp. 60° F.", the other that of "Urinometer Germany"; and a Westphal balance. This latter is an instrument which measures the upthrust on a mass of constant volume; it is immersed in the liquid of which the specific gravity is required. Since by the principle of Archimedes the upthrust is equal to the weight of fluid displaced and the volume of fluid thus displaced is constant, it follows that the upthrust will be proportional to the specific gravity. The weight necessary to counteract this upthrust is arranged on a cantilever, from the end of which the weight for immersion is attached, and from the readings obtained the specific gravity is given directly.

The results obtained are shown in Tables I, II, III and IV.

Reference to these tables will show that when the temperature varies from 4·4° to 37·8° C. (40° to 100° F.) there is a fall in the specific gravity of quite an appreciable amount, almost 10 on the scale. That, in a climate such as this, the tempera-

TABLE I.
Specific Gravity of Commercial Distilled Water.

Temperature.	Specific Gravity.		
	"Urinometer Germany."	"Urinometer Tp. 60° F."	Westphal Balance.
43·3° C. (110° F.)	993	993	993
37·8° C. (100° F.)	994	995	995
32·2° C. (90° F.)	995	995	996
26·7° C. (80° F.)	996	996	998
21·1° C. (70° F.)	997	998	999
15·6° C. (60° F.)	998	1,000	1,000
10·0° C. (50° F.)	999	1,001	1,000
4·4° C. (40° F.)	1,000	1,002	1,001

TABLE II.
Specific Gravity of 2% Sodium Chloride Solution.

Temperature.	Specific Gravity.		
	"Urinometer Germany."	"Urinometer Tp. 60° F."	Westphal Balance.
43° C. (110° F.)	1,008	1,009	1,006
38° C. (100° F.)	1,009	1,010	1,009
32° C. (90° F.)	1,011	1,012	1,011
27° C. (80° F.)	1,013	1,014	1,013
21° C. (70° F.)	1,015	1,017	1,014
16° C. (60° F.)	1,017	1,018	1,015
10° C. (50° F.)	1,015	1,017	1,016
4° C. (40° F.)	1,014	1,016	1,017

TABLE III.
Specific Gravity of Specimen of Urine.

Temperature.	Specific Gravity.		
	"Urinometer Germany."	"Urinometer Tp. 60° F.	Westphal Balance.
43° C. (110° F.)	1,017	1,019	1,016
38° C. (100° F.)	1,019	1,021	1,019
32° C. (90° F.)	1,021	1,023	1,021
27° C. (80° F.)	1,023	1,024	1,023
21° C. (70° F.)	1,025	1,026	1,024
16° C. (60° F.)	1,026	1,026	1,025
10° C. (50° F.)	1,027	1,027	1,026
4° C. (40° F.)	1,028	1,028	1,027

TABLE IV.

Specific Gravity of Urine containing 1·8% of Glucose Added.

Temperature.	Specific Gravity.		
	"Urinometer Germany."	"Urinometer Tp. 60° F."	Westphal Balance.
43° C. (110° F.)	1,022	1,024	1,022
38° C. (100° F.)	1,025	1,026	1,025
32° C. (90° F.)	1,026	1,027	1,026
27° C. (80° F.)	1,027	1,029	1,027
21° C. (70° F.)	1,028	1,030	1,028
16° C. (60° F.)	1,029	1,030	1,029
10° C. (50° F.)	1,029	1,032	1,029
4° C. (40° F.)	1,030	1,033	1,030

ture of a specimen of urine may be far removed from what is usually regarded as normal, can be seen from Table V, which gives the temperature of an ordinary specimen lying on the laboratory bench during an average summer day.

TABLE V.

Temperature of Urine Standing During Average Summer Day.

Time.	Temperature of Urine.	Shade Temperature.
9 a.m.	27·8° C. (82° F.)	31·1° C. (88° F.)
10 a.m.	28·9° C. (84° F.)	32·2° C. (90° F.)
11 a.m.	30·0° C. (86° F.)	34·4° C. (94° F.)
12 noon	30·6° C. (87° F.)	35·6° C. (96° F.)
1 p.m.	31·7° C. (89° F.)	36·1° C. (97° F.)
2 p.m.	32·7° C. (91° F.)	36·1° C. (97° F.)
3 p.m.	33·3° C. (92° F.)	37·8° C. (100° F.)
4 p.m.	34·4° C. (94° F.)	38·9° C. (102° F.)
5 p.m.	35·0° C. (95° F.)	38·4° C. (101° F.)
6 p.m.	35·6° C. (96° F.)	37·8° C. (100° F.)

The temperature range throughout the year can furthermore be imagined from Figure I, which gives the average and extreme maximum and minimum temperatures for Mount Isa. It will be noticed that the temperature may vary anywhere between −2·8° C. (27° F.) and 45° C. (113° F.). (Figure I.)

Evaporation.

Another factor thought likely to affect the specific gravity was evaporation. During most of the year, in a climate such as this, the relative humidity is low and the temperature is high; consequently one would expect the amount of evaporation to be great. To estimate the effect which evaporation might have on the specific gravity of a specimen of urine the following experiment was performed. Unfortunately at the time of experimentation the wet season was on and humidity readings were much higher than average.

An ordinary specimen of urine in a cylindrical specimen glass was tested throughout the day at hourly intervals. The volume was taken and the specific gravity was estimated by means of the Westphal balance, the specimen of urine being brought to a temperature of 30° C. each time to eliminate any changes due to the temperature of the specimen. Also each hour dry-bulb and wet-bulb temperature readings were taken and the humidity was obtained by the use of the following psychrometric formula:

$$E = E_w - 0{\cdot}00066B(t - t_w)[1 + 0{\cdot}00115(t - t_w)]$$

where E is the actual vapour tension in centimetres of mercury, E_w is the vapour tension in centimetres of mercury corresponding to temperature t_w, B is the barometric pressure in centimetres of mercury, t is the dry-bulb and t_w the wet-bulb temperature in degrees Centigrade. The relative humidity is then given by the formula: $\frac{100E}{E_t}$, where E_t is the vapour tension corresponding to temperature t.

The results obtained are shown in Table VI. It will thus be seen that over a period of nine hours, during which the average relative humidity was 53%, the evaporation was 8·0 cubic centimetres from 181 cubic centimetres, the specific gravity thus being increased by an amount for all practical purposes negligible, namely, from 1,024 to 1,025. This corresponds to the theoretical estimation of the specific gravity which would result from concentrating 181 cubic centimetres of specific gravity 1,024 to 173 cubic centimetres, thus:

$$1000 + \left(\frac{181}{173} \times 24\right) = 1025$$

The evaporation in centimetres can be determined as follows:

The specimen glass, in the part where evaporation took place, had an internal diameter of 4·0 centimetres, the radius being therefore 2·0 centimetres. The volume of evaporated fluid is related to the vertical height of evaporation by the formula $V = \pi r^2 h$ or $h = \frac{V}{\pi r^2}$. For a change in volume of 8·0 cubic centimetres the evaporation is 0·6 centimetre.

Discussion.

It would seem, therefore, that in a climate such as this, and there must be many such in Australia and in other parts of the world, considerable inaccuracies are likely to occur in the reading of the specific gravity of a specimen of urine, if the usual precautions only are taken. A rise in temperature, which in such cases may be considerable, causes quite an appreciable fall in the specific gravity reading, while the evaporation, if great,

TABLE VI.

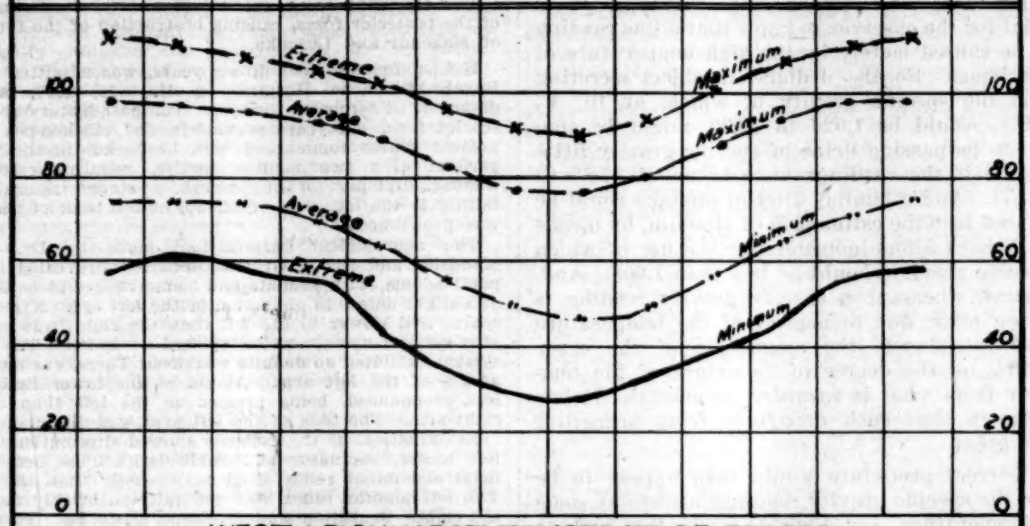
Evaporation from a Specimen of Urine.

Time.	Volume of Urine in Cubic Centimetres.	Evaporation in Cubic Centimetres.	Specific Gravity.	Dry-Bulb Temperature.	Wet-Bulb Temperature.	Relative Humidity.
9 a.m.	181	—	1,024	29° C.	26° C.	79%
10 a.m.	180	1	1,024	30° C.	26° C.	73%
11 a.m.	180	1	1,024	32° C.	26° C.	62%
12 noon ..	179	2	1,024	33° C.	26° C.	57%
1 p.m.	178	3	1,024	35° C.	26° C.	49%
2 p.m.	177	4	1,024	36° C.	26° C.	45%
3 p.m.	176	5	1,024	37° C.	26° C.	42%
4 p.m.	175	6	1,025	37° C.	26° C.	42%
5 p.m.	174	7	1,025	37° C.	26° C.	42%
6 p.m.	173	8	1,025	36° C.	25° C.	41%

MOUNT ISA TEMPERATURE

(13 Year Average)

Based on records kept at West Leichhardt Telegraph Station
15 Air Miles from Mount Isa



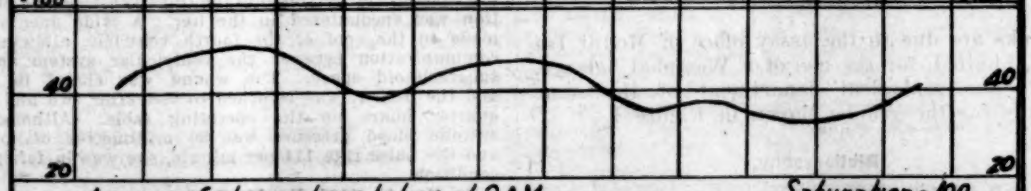
WEST LEICHHARDT TEMPERATURE RECORD

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual	
Extreme Maximum	110·0°	108·8°	105·0°	102·0°	95·5°	91·5°	89·5°	93·5°	101·0°	107·0°	111·0°	113·0°	113·0°	Extreme Maximum
Average Maximum	96·8°	95·3°	93·5°	89·2°	82·1°	77·1°	76·2°	80·4°	87·9°	93·7°	97·8°	97·8°	89·0°	Average Maximum
Average Minimum	74·2°	73·4°	70·0°	63·5°	55·4°	49·7°	46·2°	48·7°	56·8°	64·5°	70·6°	74·0°	62·2°	Average Minimum
Extreme Minimum	61·0°	57·0°	55·8°	42·5°	34·0°	29·6°	27·0°	28·5°	38·5°	46·0°	57·0°	56·2°	27·0°	Extreme Minimum

MOUNT ISA AVERAGE MEAN RELATIVE HUMIDITY

(13 Year Average)

Based on records kept at West Leichhardt Telegraph Station



Average of observations taken at 9 A.M. Saturation = 100.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual	
	48	51	45	39	45	47	43	35	37	32	34	41	41	

FIGURE I.

causes a much smaller rise. Hence, at a temperature of 37·8° C. (100° F.) a patient who consistently passed urine with a specific gravity of, say, 1,008 might be regarded as having at least one of the signs of chronic nephritis, whereas, if the specific gravity readings were taken at 10° C. (50° F.), the readings would be in the region of 1,014 to 1,016 and no suspicion would be aroused. Furthermore, in performing the water function tests, in which the maximum specific gravity is of such importance, such as those of Volhard and Fishberg, it is essential for the observer to know that a low reading might be caused merely by the high temperature of the specimens. So also a diabetic subject secreting a urine the specific gravity of which, at 10° C. (50° F.), would be 1,028 to 1,030, might be considered to be passing urine of specific gravity little over 1,020 if the readings were taken at 37·8° C. (100° F.). And a similar kind of mistake could be introduced into the estimation of albumin, by means of the Esbach albuminometer, for the use of which the specific gravity should be less than 1,008. And, in general, whenever a specific gravity reading is taken, an error due to neglect of the temperature may be introduced, the magnitude of the error depending on the degree of departure of the temperature from what is regarded as normal. It has been shown that such departure from normality may be great.

The correct procedure would then appear to be to take the specific gravity readings always at some fixed temperature, say 15·6° C. (60° F.), and as soon after the specimen has been passed as practicable. In this way the temperature and evaporation effects could be eliminated.

Summary.

Attention is drawn to the recognized but usually forgotten fact that changes in temperature produce quite appreciable changes in the specific gravity of fluids, and therefore of urine. These effects would appear to be not inconsiderable in the hot, dry climates experienced over much of the continent of Australia.

Some experiments to show these effects are presented.

Acknowledgements.

Thanks are due to the assay office of Mount Isa Mines, Limited, for the use of a Westphal balance, and to the geological department of the same company for the graphs shown in Figure I.

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Reports of Cases.

A CASE OF ARACHNOIDITIS OF THE POSTERIOR CRANIAL FOSSA.[1]

By A. E. COATES,
Melbourne.

THE following is an account of a case of arachnoiditis of the posterior fossa, causing obstruction of the foramina of Magendi and Luschka.

H.A., a female, aged fifteen years, was admitted to the Royal Melbourne Hospital on May 25, 1937, with a diagnosis of cerebellar tumour. The past history recorded scarlet fever six years previously and chicken-pox. The present illness commenced with headaches in the frontoparietal area two months earlier, usually present on waking, diplopia for one month, a staggering gait and falling to the left side. Stiffness of the back of the neck was pronounced.

The neurological examination, made by Dr. H. F. Maudsley and Dr. E. Graeme Robertson, revealed intense papilloedema, with exudate and hæmorrhages in both fundi and slight defect in abduction of the left eye. Nystagmus, coarse and slower to the left than the right, was present, also vertical nystagmus on upward deviation. The motor system exhibited no definite weakness. There was moderate ataxia of the left arm. Ataxia of the lower limbs was less pronounced, being greater on the left than on the right side. The tone of the left arm was diminished.

Examination of the reflexes showed diminution of the left biceps, supinator and ankle jerks. The left superficial abdominal reflex tired more easily than the right. The left plantar reflex was not quite so briskly flexor as the right. Sensation was normal in all forms. There was no reaction to the Wassermann test. The pressure of the cerebro-spinal fluid at lumbar puncture was 300 millimetres of water. The total protein content was 40 milligrammes *per centum*. There was no increase in globulin, and there were no cells. Vomiting was troublesome, and headache and neck pains were very severe.

It was thought likely that a cerebellar tumour was present, and an operation was performed on May 28, 1937. Under local anæsthesia a cross-bow incision was made and the posterior fossa was decompressed. The dura was tense. Trephine openings were made in the occipital area and the lateral ventricles were tapped. Fluid under great pressure flowed freely. The dura was incised and the laminæ of the atlas were removed in order to allow the herniating tonsils of the cerebellum to be free. No tumour was found. Thickening of the arachnoid and matting up of adhesions about the roof of the fourth ventricle were revealed. Dilatation of the fourth ventricle was observed and the thick posterior medullary velum was punctured and a soft rubber catheter (number four) was passed up the aqueduct of Sylvius into the third ventricle. No obstruction was encountered in the iter. A wide opening was made in the roof of the fourth ventricle, allowing free communication between the ventricular system and the subarachnoid space. The wound was closed in layers and the patient was returned to bed after two and three-quarter hours on the operating table. Although the systolic blood pressure was 80 millimetres of mercury and the pulse rate 114 per minute, she was in fairly good condition.

On May 31, 1937, Dr. Maudsley reported that the papilloedema was less than before operation. The headache had gone and vision was improving. On June 8, 1937, Dr. Robertson reported on her neurological condition. There had been no improvement during the previous week. On June 11, 1937, she was obviously very ill. There was

[1] The patient described herein was shown at a meeting of the Victorian Branch of the British Medical Association at the Royal Melbourne Hospital on May 18, 1938.

a divergent squint, the neck was stiff, and the blood pressure was rising. It was decided that she again had an obstruction of the fourth ventricle and acute hydrocephalus was developing. An experience of a previous case with exactly similar findings in which the fourth ventricle had been freely opened and in which the patient had eventually died indicated that something drastic should be done. *Post mortem* examination in the previous case had revealed a complete sealing over of the foramina of Magendi and Luschka by adhesions to the overhanging cerebellum. The wound was accordingly reopened under local anæsthesia and the cerebellum was exposed and found to be gummed up onto the roof of the fourth ventricle, which was again very dilated. The lateral ventricles were tapped. It was obvious that there was little hope of permanently relieving the obstruction of the fourth ventricle. The vermis of the cerebellum was divided with a diathermy knife in the mid-line and the whole of the roof of the fourth ventricle was laid open. The two parts of the cerebellum being thus separated, there was a perfectly free flow of cerebro-spinal fluid from the ventricles into the subarachnoid space. The dura, muscles and skin were sutured, and the patient was returned to bed. After two hours' operation the systolic blood pressure was 90 millimetres of mercury. The pulse rate was 50 per minute when the patient returned to bed. She lay in the prone position on the special operating trolly for some hours. A blood transfusion was given. During the night the respiration rate dropped to 10 per minute and the pulse rate was 65 beats per minute.

Improvement followed. There was a little incontinence of urine in the second week; but the wound healed by first intention, and the patient left hospital on July 14, 1937.

When examined early in 1938, her vision was normal; but there were slight nystagmus, some ataxia and unsteadiness in gait. Otherwise she was perfectly well. On May 18, 1938, she had no symptoms. She could walk a straight line, could stand with eyes closed, had no nystagmus, and only occasionally lurched a little on walking.

Comment.

The surgical problem of relieving an obstruction of the fourth ventricle has always been a difficult one. Various methods have been suggested. The first and obvious method was tried in this case, that is, puncturing and catheterizing the thick posterior medullary velum. Cannulas have been placed in this situation to provide permanent drainage; but in all such operations there is the tendency for fresh arachnoidal adhesions to form and block the orifice. The fact that the cerebellum "sits" on the fourth ventricle makes the gumming up of any artificial opening almost certain. Observations on the *post mortem* specimen of the case referred to indicated that something had to be done to provide an adequate exit for the fluid in the fourth ventricle. Puncture of the *lamina terminalis* (that is, the anterior wall of the third ventricle) has been advocated by Stookey, and this procedure was considered in this case.

The recovery of this patient, the complete absence of all signs of obstructive hydrocephalus, and the slight disability of cerebellar origin following the section of the vermis encourage one to employ this operation as a means of solving an admittedly difficult problem.

A CASE OF RETAINED CORPUS LUTEUM AS A CAUSE OF SECONDARY AMENORRHŒA.

By DAVID ZACHARIN, M.B., B.S. (Melbourne),
Clinical Assistant to the Out-Patient Gynæcologist, Women's Hospital, Melbourne.

THE following case is of interest in offering a possible explanation of secondary amenorrhœa in otherwise healthy girls to whom endocrine treatment so often fails to restore the menstrual flow.

K.K., an unmarried female, aged twenty years, was first seen on April 18, 1936, when she complained of amenorrhœa since January 26, 1936. The onset of menstruation occurred when she was aged fourteen years. There had been slight irregularity. The flow occurred at intervals of about six weeks, and lasted two and a half days.

Examination revealed her to be an apparently perfectly healthy and well-developed girl, with a good colour. Examination of the heart and lungs disclosed no abnormality. Bimanual examination was difficult as she was a *virgo intacta*. The cervix was small and soft, and the uterus was small, anteverted and actually anteflexed. The fornices were clear.

Her condition was regarded at the time as an endocrine dysfunction, and she was given treatment with ovarian residue in a dose of 0·3 gramme (five grains) twice a day and thyreoid extract in a dose of 0·015 gramme (one-quarter of a grain) three times a day. On May 22, 1937, a course of injections of folliculin hormone ("Progynon *B* Oleosum"), six in number, was commenced. No result was obtained.

On June 26, 1937, a further bimanual examination of the pelvis disclosed a somewhat enlarged right ovary, and the provisional diagnosis of retained *corpus luteum* was made, and operation was advised.

This was performed on July 26, 1937. Numerous retention cysts were found and punctured in both ovaries, and a large *corpus luteum* was removed from the right ovary. The patient left hospital and was again given thyreoid extract in a dose of 0·015 gramme (one-quarter of a grain) three times a day.

She menstruated on September 5, 1937, for three days, with no malaise or dysmenorrhœa. On October 1, 1937, only one clot was passed. There was no further menstruation up to November 27, 1937, when another course of six "Progynon" injections was commenced. Menstruation occurred on November 28, 1937, for two days, and from then on has been occurring without a break at intervals of five to six weeks, the flow continuing for two and a half days. No therapy of any sort has been used since December, 1937.

Acknowledgement.

I desire to express my thanks to Dr. J. Leon Jona for permission to publish this report; the work was done in his clinic at the Gynæcological Department of the Women's Hospital, Melbourne.

Reviews.

X RAY DIAGNOSIS.

"A TEXT-BOOK OF X-RAY DIAGNOSIS", written by British authors and edited by S. Cochrane Shanks, Peter Kerley and E. W. Twining, is far and away the best book on diagnostic radiology that has yet appeared.[1] The work comprises three volumes, two of which have been received for review, while the third is still in the hands of the printers. Volume I deals with the cardiovascular and respiratory systems and with the urinary system and male genital tract. Volume II is devoted to the radiology of the alimentary and biliary tracts, of the abdomen generally, and of the female genital tract and to obstetrical radiology. The authors point out the need for expert interpretation in X ray work.

The descriptions of the fluoroscopic methods of cardiac and pulmonary examinations are complete and most valuable. This section should be completely studied by every radiologist, however skilled, as there is much to be learned

[1] "A Text-Book of X-Ray Diagnosis", by British Authors, in three volumes; edited by S. C. Shanks, M.D., P. Kerley, M.D., M.R.C.P., D.M.R.E., and E. W. Twining, M.R.C.S., L.R.C.P., D.M.R.E. Volume I; 1938. Crown 4to, pp. 610, with 398 illustrations. Price: 50s. net. Volume II; 1938. Crown 4to, pp. 469, with 307 illustrations. Price: 42s. net. London: H. K. Lewis and Company Limited.

from it. For the radiography of chests it is advisable to have a focal distance of six feet or two metres and to use a high milliampèrage and a fine focus (rotating anode) tube. The usual postero-anterior and right and left oblique views are taken; various excellent skiagrams are inserted by the editors to show the film-projection of the various heart chambers. The kymograph and cineradiograph are of some value, but further development of these methods is necessary. The authors differ from most authorities on the radiography of lungs in preferring films in multiple planes to stereoscopy. Tomography is recommended in certain cases in which one selected plane in the lung has to be examined. The descriptions of the appearances of the normal lungs and hilar regions are clear and concise, and the authors agree that the markings which extend from the hila are mainly due to shadows cast by the pulmonary vessels. An interesting experiment is quoted in which a catheter was passed through one of the veins of the arm to the right auricle; when sodium iodide was injected it was found that the resulting dense shadows of the pulmonary arteries corresponded with the usual markings in the perihilar regions. The description of the lymphatic and glandular drainage of the lungs is excellent and is well illustrated. The authors doubt whether bronchitis should be diagnosed by radiography, and state that in most cases the evidence of bronchial thickening is most unconvincing; in emphysema the bronchi certainly show out more clearly than in normal lungs. Congenital and acquired atelectasis is dealt with very concisely, and the characteristic appearances are described and illustrated. Discussing pulmonary fibrosis, the authors state that post-radiation fibrosis is frequently seen and that in their experience it tends to disappear after many months; they consider that a good deal of the lung density is due to œdema and that permanent fibrosis following radiation is rare. In cases of lung abscess, if the patients are to be subjected to surgical operations, it is suggested that the photographs for localization be taken while the subjects are in the recumbent position, since an abscess generally lies higher in the chest in that position.

In the chapter on pneumonokoniosis the authors again insist that silica is the only material which leads to the formation of the typical nodules. Coal miners' lungs become black in anthracosis, but coal does not produce the nodular fibrosis seen in silicosis. One important point noted in the book is that silica acts more quickly when associated with some alkali. This fact is illustrated in the silicosis of soap-brick makers. The earliest case of silicosis diagnosed by the authors took over four years to develop. The chapters on pulmonary tuberculosis are very clear and to the point; the value of X ray examination is stressed, and the authors (and various others quoted) consider that it is extremely rare to find tubercle bacilli in the sputum and no radiological change in a good film. In the chapter on miliary tuberculosis it is stated that frequent cases of healed miliary tuberculosis are encountered—a general experience of radiologists which has rather been doubted by physicians. Neoplasms of the lung are exhaustively described, and the authors point to the value of "Lipiodol" investigation and of the tomograph in these diseases. Here again the illustrations given are most valuable and interesting. At the end of the section on chest conditions a comprehensive bibliography is supplied.

The section dealing with lesions of the male genital organs and urinary tracts is well arranged and embraces the modern practice in the examination of these important regions. No new work is included, but the whole subject is dealt with in an intelligible way.

In the second volume Shanks, Kerley and Twining deal with the radiology of the digestive and biliary tracts and the female genital tract and with obstetrical radiology. After considering the salivary glands and pointing out the value of sialography in various conditions, the authors pass on to the radiological investigation of the pharynx, œsophagus, stomach and intestines. Their description of fluoroscopic technique is detailed and clear. As foreign bodies in the œsophagus are difficult to distinguish from calcified laryngeal cartilages and arytenoids, Twining recommends that the patient take alternate drinks of barium cream and water. These clear a normal œsophagus, but fail to clear one containing an impacted foreign body. This procedure is considered more reliable than the practice of giving the patient a cotton wool pledget soaked in barium cream to swallow.

Describing X ray investigation of the stomach, the authors advise the use of the usual barium sulphate suspension in gum, and call attention to the more rapid passage of barium as compared with bismuth meals. Their description of the art of fluoroscopy is complete and convincing. The authors emphasize the need for expert observers; inexpert workers can be so misleading in their findings as to be dangerous. "Unless the clinician is also versed in the technique of radiology, he may be misled by inefficient radiological investigation." This truth is not generally appreciated by the profession. The authors' figures show a four to one preponderance of duodenal over gastric ulcers. An important point in diagnosis is that a healing gastric ulcer has a conical appearance owing to the fact that it heals from below. The illustrations of gastric lesions in the work are of great educational value. An interesting chapter on miscellaneous gastric conditions treats of hypertrophic pyloric stenosis, foreign bodies, extragastric tumours, gastric volvulus and other abnormalities. It is recommended that examination of the duodenum should be made while the subject is in the upright position; it is only occasionally necessary to study this region when he is prone or recumbent. Pressure is generally required to fill the cap or to reveal a deformity. The normal cap is described and the following chapter is devoted to the radiological features of ulcer and other inflammatory lesions. The persistent fleck or crater is the one sign of importance and the radiologist should always look for it, using "graduated compression". This counsel of perfection is often unattainable, but a constant deformity is of the greatest diagnostic value. Various types of deformity are described and illustrated. The authors point out the extreme difficulty of deciding when a duodenal ulcer has healed. Duodenal diverticulosis is described. It occurs in 3·3% of autopsies. Stasis in a diverticulum is of importance since it may indicate the necessity for surgical interference. The authors consider that duodenal ileus is due to pressure by the superior mesenteric vessels; the symptoms are usually those of a bilious attack. They are relieved when the patient lies down and they tend to occur periodically. The thirteenth chapter deals with the appearances of the stomach and duodenum after surgical operation has been performed and contains much new matter and many attractive illustrations. The chapter on lesions of the diaphragm is devoted to hernia of the stomach, "thoracic stomach", various types of eventration and subphrenic abscess.

In the section on the small intestine the authors point out the value of plain films showing gaseous distension and of the films taken when the patient is in the erect position and revealing fluid in obstructed coils. In cases of acute appendicitis X ray examination is not favoured by the authors, but they consider it of value in the chronic types, especially in establishing fixation and adhesions to the ileum *et cetera*. The chapter on colonic disease is very full and orthodox methods are recommended. The modern methods of investigation of the biliary tract are described fully. Serial radiography after the subject has consumed a fatty meal is of value, as very often the shadows of the biliary ducts may be seen in the films. The authors have been unable to determine the manner in which the gall-bladder empties after meals, but there appears to be no doubt that muscular action is responsible. "Pitressin" has been found of value in expelling gas from the intestines. Preliminary films are taken and the usual routine examinations are made after the patient has taken the dye. Fast exposures are used.

The section on the female genital tract is interesting and the technique of insufflation and injection is described in detail. In obstetrics radiology is becoming of great use and rapid exposure times at higher kilovoltages than are usually employed are recommended. The earliest stage at which pregnancy may be diagnosed in the most favourable circumstances is given as the thirteenth week.

The Medical Journal of Australia

SATURDAY, SEPTEMBER 17, 1938.

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THE MILK PROBLEM.

From time immemorial countless multitudes of the world's coloured inhabitants have lived healthy, virile and vigorous lives without consuming one drop of cow's milk. Examples of this fact are the American Indians, the Maoris and other races of the Pacific, and our own Australian aborigines. Even members of the white race, inhabitants of the far outback, may never have an opportunity of drinking cow's milk. In 1929 V. B. Appleton commented upon the fine physique, strength and endurance and excellent teeth of Chinese rice-eating coolies who had never tasted cow's milk. Not everyone is enthusiastic regarding the use of cow's milk as food. Certainly it falls short in some respects of a perfect food. Its protein is probably not of the best quality. Iron, copper and iodine are somewhat deficient, and other constituents do not appear to be ideally balanced for the needs of the human body. Certain vitamins are deficient or absent. It has been also urged against milk that, being so satisfying to the appetite, it may prevent children from consuming a sufficiency of other foods. Again, an occasional intolerance to milk is encountered. Certain persons exhibit an idiosyncrasy to it. Certainly many affirm that milk does not "agree" with them, and to infants it must be supplied in modified form. Doubtless civilization could still survive in the complete absence of milk. At the same time cow's milk constitutes a food of the highest value for mankind, and especially for the young.

The League of Nations has considered the milk problem with the closest attention and the utmost diligence. Every aspect of the question has been exhaustively dealt with in the June, 1937, number of the *Bulletin of the Health Organisation*, by H. C. Bendixen, G. J. Blink, J. C. Drummond, A. M. Leroy and G. S. Wilson. It is obvious that if milk is to be a useful article of diet, it must be possible to consume it in safety. If it be contaminated with pathogenic organisms, and if such a danger cannot be obviated, it would be far better to exclude it totally from dietary substances. Milk may be contaminated by infection not only from the cow, but also from water and from the human personnel, and possibly, as the report states, from rodents also. The problem of disease in cattle is very serious. As stated in the report, bovine tuberculosis is very prevalent in Great Britain, the northern districts, including Scotland, being more heavily infected than the southern. On an average about 40% of cattle in dairy herds react to the tuberculin test; 40% slaughtered in abattoirs are found to be tuberculous. Probably about 0·5% of all milch cows suffer from tuberculosis of the udder, and consequently excrete tubercle bacilli in the milk. Of the milk coming from individual herds an average of about 7% throughout the country is infected, the figure varying between 2% and 21% for different districts. Recent examinations have disclosed the fact that all "bulked milk" arriving in London in rail tanks contains virulent tubercle bacilli, often in considerable numbers. Contagious abortion is a widespread disorder and is considered to be of even greater economic importance than tuberculosis. Tank milk going into London would appear to be uniformly infected with *Brucella abortus*. Milk from tuberculin-tested herds con-

stitutes no exception. Mastitis in cattle may be caused by several organisms, of which the most common is *Streptococcus agalactiæ*. This organism is apparently non-pathogenic to man; but its presence is objectionable, since milk from infected animals contains pus cells and sometimes blood. *Streptococcus pyogenes* is another cause of mastitis. As this is essentially a human pathogen, infected cattle may have received the organism from a healthy human carrier or from one suffering from scarlet fever or septic sore throat. Salmonella infections are not uncommon in cattle, the location of the disease being chiefly intestinal. *Bacterium typhi-murium* is more common amongst older animals. This organism is pathogenic to man; so also is *Bacterium enteritidis*, which is more common in calves.

Bendixen, Blink, Drummond, Leroy and Wilson state that among the less important diseases that may affect milk directly or indirectly and make its use undesirable or dangerous to human beings, are foot-and-mouth disease, cowpox, anthrax, suppurative infections of various parts of the body (especially septic metritis), and diarrhœa, due either to Johne's disease or another cause. They also consider the frequency of milk-borne disease in human beings. Such illness, rarely obtrusive, is not generally found unless specifically sought. No diseases are exclusively milk borne. Those conveyed by milk may also be carried by other media, such as air, water or food. Some pathogenic organisms present in milk, especially the tubercle bacillus and *Brucella abortus*, give rise to clinically demonstrable disease in only a very small minority of persons who consume the food. Tuberculosis in man may be caused by the human or bovine type of the bacillus. In Great Britain bacteriological investigations of the type of bacillus causing different forms of tuberculosis have been conducted over many years. In every variety of tuberculosis the frequency of infections with the bovine type is higher in Scotland than in England or Wales. The existence of undulant fever can be proved only by bacteriological investigation. It is believed that many clinicians are still unaware of the part played by *Brucella abortus* in the causation of the human disease. Epidemic milk-borne diseases have had an amazing incidence. They include scarlet fever, septic sore throat, diphtheria, typhoid fever, paratyphoid fever, dysentery and gastro-enteritis.

Considering milk-borne diseases as a whole, Bendixen and his collaborators state that in Great Britain during the twenty-four years from 1912 to 1935 there were over 100 outbreaks of epidemic disease, affecting about 12,000 persons. In the same period about 150,000 persons contracted tuberculosis of bovine origin through the consumption of milk. Of these, over 60,000 persons died. The number of those infected with undulant fever was not ascertained, but probably amounted to several thousands. Altogether a sinister galaxy of disease is revealed. An insistent question is, what can be done to prevent this staggering morbidity. There is only one means of freeing milk from tubercle bacilli, namely, the eradication of tuberculosis from dairy herds. As the report indicates, veterinary inspection alone is an unreliable method of detecting tuberculosis in its early stages, and testing by animal inoculation is too slow to prevent further dissemination of the disease. The only satisfactory way is to submit every animal to a tuberculin test and to remove the reactors. The effect of this practice is that herds will be raised containing only non-reacting animals. The report emphasizes that tuberculin tests of the non-infected portions of the herds should be made at intervals of three, six or twelve months. No herd may be considered free from tuberculosis until all infected animals have been removed and the entire herds have failed to react to the tuberculin test for two or three years in succession. The matter, of course, bristles with practical difficulties; but the problem must be faced. The cost of the procedure suggested would be vast, but would be offset by a very great economic gain in the diminution or abolition of certain diseases, with a resulting increase in human health and efficiency.

Diseases other than tuberculosis merit consideration, and we are entirely in accord with the following statement, which appears in the report: "It is our considered and emphatic opinion that all liquid milk for human consumption should be adequately pasteurized or boiled." It has been

urged against pasteurization that certain vitamins are destroyed or diminished in the process. This opinion should carry no weight at all, since vitamins can be adequately supplied by other means. In remote areas pasteurization may be impracticable; but milk can always be boiled. Nothing is now heard of the once vaunted method of sterilizing milk by means of lactic acid.

Current Comment.

MESENTERIC LYMPHADENITIS.

It occasionally happens that a surgeon opens the abdominal cavity in order to deal with what is believed to be an acute abdominal emergency, but the only lesion which he can discover is an enlargement of the mesenteric lymph nodes. Names have a habit of persisting in the literature of medicine, whether they are appropriate or not, and the term *tabes mesenterica*, which is a survival from the eighteenth century, is still used to describe the condition of chronic inflammatory enlargement of the mesenteric lymph glands. If asked the cause of this condition, most medical men would unhesitatingly say tuberculosis; but it is by no means sure that this is always so.

William E. Adams and Mary B. Olney describe thirteen cases of mesenteric lymphadenitis, which they regard as a definite clinical entity.[1] They point out that caseation, suppuration and calcification, which are, of course, strongly suggestive of tuberculosis, do not always occur, and that the glands are not even matted together in all cases. They report eight cases in which a positive diagnosis of mesenteric lymphadenitis was made at operation, and five others in which a presumptive diagnosis was arrived at, but no operation on the patient was carried out. All the patients were children, the oldest being aged thirteen years and the youngest one year. The history was one of abdominal pain, usually of a cramping nature, often generalized, but sometimes localized to the right side or the epigastrium. Tenderness on palpation was frequent. Vomiting was a constant symptom. The temperature was raised and in some cases there was a moderate or even high degree of leucocytosis, whereas in others the white blood cells were little altered in number. Sometimes a mass could be felt in the abdomen. It is easy to see how, in the case of the infant of one year, the clinical picture of a pallid and very ill child who had suffered from periodic abdominal pains for twenty-four hours and in whom a mass could be felt in the right lower abdominal quadrant, would strongly suggest intussusception. In all the patients submitted to operation swollen lymph nodes were discovered, but no other lesion was found to account for the condition. The five patients on whom operation was not performed had similar clinical appearances, but as there was nothing definitely pointing to any severe abdominal emergency, expectant treatment alone was used, with satisfactory results.

Discussing the ætiology, Adams and Olney point out that investigation of glands removed from patients has failed to reveal evidence of tuberculosis in a certain group. In fact, taking into consideration the results of Mantoux tests and biopsies with cultural tests, they believe the non-tuberculous type of the disease to be much commoner than the tuberculous. Disease of the appendix has been considered as a cause, but this possibility seems very unlikely in view of the absence of pathological changes in that organ, the rarity of any considerable degree of enlargement of the mesenteric lymph nodes in cases of uncomplicated acute appendicitis, and the persistence of symptoms in some cases after appendicectomy. It would seem, therefore, that this condition might well be a local manifestation of a general disturbance. Eight of the cases of Adams and Olney were associated with an infection of the upper part of the respiratory tract, and in one case hæmolytic streptococci were isolated from a lymph node, a finding which has been reported by other workers.

If the diagnosis of mesenteric lymphadenitis on clinical grounds only is to be attempted, it is necessary to outline the symptoms with some clarity. These would appear to be as follows. The abdominal pain is colicky in nature and the attacks tend to recur. There is frequently a history of a recent infection of the upper respiratory passages. The onset as a rule is sudden and associated with nausea and vomiting. Pain may be generalized or localized, and tenderness may be present, but there is no consistency in the latter finding. The physician is unable as a rule to palpate a definite abdominal mass in the non-tuberculous variety, and therefore he experiences much difficulty in arriving at a definite diagnosis. Appendicitis and intussusception are the most important lesions which he must exclude, and if he can do this, the history of previous attacks and the nature of the abdominal distress, together with the lack of convincing localizing signs, would probably help him in arriving at the truth. The authors state that when a definite diagnosis cannot be made, exploratory laparotomy should be carried out. The prospect of permanent cure appears to be quite good.

Every practitioner who examines numbers of children and young persons must have had experience of this condition, and the possibility of its occurrence should be more widely recognized. It is a stimulant to thought to mention that at the head of the list of references to the literature supplied by Adams and Olney stands the title of a paper, "Abdominal Pain of Throat Infections"—an implied dogmatism which may help to fix the condition clearly in our minds.

[1] *Annals of Surgery*, March, 1938.

Abstracts from Current Medical Literature.

MORBID ANATOMY.

Fatty Infiltration and Cirrhosis of the Liver in Diabetes and Alcoholism.

C. L. CONNOR (*The American Journal of Pathology*, May, 1938) gives a concise review of conditions under which fatty infiltration of the liver develops: starvation or deficient absorption of food, diabetes, chronic alcoholism, experimental phloridzin administration, vitamin B_1 deficiency, and poisoning with such agents as chloroform, phosphorus and carbon tetrachloride. In all these conditions there is interference with the tissue oxidation of carbohydrate, and consequently with normal fat metabolism. In the fatty liver due to chronic alcoholism several factors are concerned. First, alcohol itself depresses tissue oxidation and is included by Peters and Van Slyke as a cause of "histotoxic anoxia"; secondly, alcoholism is in 80% of cases associated with absolute or relative starvation, particularly in regard to carbohydrates; and thirdly, there is a minor factor, a deficiency of vitamin B_1 in the diet. The liver is enlarged and may be so swollen with fat that the distended surface lobules present the appearance of cirrhosis and may cause sufficient intrahepatic block to produce jaundice and ascites. Many such patients die in coma, and at autopsy the large liver is the only prominent finding. A definite gradation has been traced from the fatty liver to hepatic cirrhosis, the sequence of events being as follows. Swelling of the liver cells leads to compression of the sinusoids, causing a reduction in circulation and consequent anoxia; this results in atrophy of the parenchyma and fibroblastic proliferation of the walls of the sinusoids. A similar connective tissue overgrowth occurs in the portal tracts, the end result being a fully developed cirrhosis. The disappearance of fat from the liver in advanced cirrhosis has been confirmed experimentally and is due to two factors: the depletion of the fat stores of the body and the discontinuance of alcohol, together with the resumption of a normal diet, particularly in regard to carbohydrates, when symptoms of cirrhosis become manifest. A similar sequence of events occurs in diabetes of long duration, and the author reports the cases of two elderly chronic diabetic patients who came to autopsy and were found to have typical portal cirrhosis with fatty infiltration.

Fragility of Red Blood Corpuscles.

E. FF. CREED (*The Journal of Pathology and Bacteriology*, March, 1938) has continued his studies on the estimation of the fragility of the red blood corpuscles. The method evolved is described in detail. The value of using distilled water of known pH, of carefully aerating whole blood, and of a standard time for mixing the blood and hypotonic saline solutions, is emphasized. Standard colour solutions are prepared for comparison and estimation of the percentage of hæmolysis is obtained. The results have been recorded graphically, and the limits of normal fragility found to be very constant. The value of estimating the percentage of hæmolysis in the more dilute solutions was difficult, and not thought to be of great significance. The only departures from the normal found by this author were diminished resistance to hæmolysis in acholuric jaundice and some other hæmolytic anæmias; increased resistance in other types of anæmia and jaundice (the resistance disappearing as the anæmia abated); and a slight difference in the shape of the curve in pernicious anæmia. The discussion of the findings in the anæmias is to be published later.

Basophile Adenoma of the Hypophysis.

A. J. RASMUSSEN AND A. A. NELSON (*The American Journal of Pathology*, May, 1938) point out the numerous inconsistencies of Cushing's syndrome of so-called pituitary basophilism. There have been many patients exhibiting this symptom complex (adiposity, *striæ atrophicæ*, hirsuties, high blood pressure, florid face) who presented no basophilic adenoma; and many basophilic adenomata have been found unaccompanied by this syndrome. Some cases have been recorded in which a chromophobic adenoma was found. Moreover, a high percentage of patients with the symptoms attributed by Cushing to pituitary basophilism have had either an adrenal cortical tumour or distinct hypertrophy of the adrenal cortex. The authors are therefore of the opinion that all basophilic adenomata should be recorded. They describe two cases in which the adenoma originated in the *pars intermedia*. The first patient, a man, aged seventy-seven years, had a tumour which measured 1·5 centimetres in diameter. It was found unexpectedly at autopsy, having caused no symptoms during life. The second patient, a woman, fifty-five years of age, died of a strangulated hernia. She had displayed a number of the symptoms of basophilism, obesity, striæ, hypertension and hirsuties; but there had been no menstrual disturbances, glycosuria or osteoporosis. A basophile adenoma, three millimetres in diameter, was found. The adrenal cortex was normal.

Intimal Hæmorrhage as a Cause of Coronary Thrombosis.

J. C. PATTERSON (*Archives of Pathology*, April, 1938) reports the finding of intimal hæmorrhage at the site of thrombosis in 32 of 37 consecutive cases. The hæmorrhages, in the author's opinion, are due to rupture of the intimal *vasa vasorum*, which arise directly from the arterial lumen, the rupture being due to high intracapillary pressure, together with softening, by atheroma, of the supporting stroma. Because intimal hæmorrhage occurs so often with complete patency of the adjacent lumen an additional factor is necessary to initiate thrombosis. The author believes that this is provided by stagnation and eddying of blood due to stenosis caused by arteriosclerotic plaques. The mechanism by which capillary hæmorrhage causes thrombosis varies. It may be due to diffusion of blood and thromboplastic substances from the intima into the lumen, to necrosis or erosion of the intima from damage to its capillary circulation, or to retrograde thrombosis commencing in the capillaries adjacent to the hæmorrhage and extending back to the lumen of the parent vessel. Any one or all of these factors may operate in an individual case.

The Effect of Certain Arsenates on the Liver.

VON GLAHN *et alii* (*Archives of Pathology*, April, 1938) cite a number of cases of cirrhosis of the liver in man due to arsenic in various forms, but state that very little experimental work has been done on the subject. The authors have administered the arsenates of lead, copper and sodium to groups of rabbits on varying diets and have studied the hepatic changes so produced by means of biopsies. Necroses were found in all parts of the lobule, but were most often situated close to the portal tracts. The healing of these necroses resulted in cirrhosis. A diet rich in carbohydrate protected the liver to a great degree. Of the rabbits receiving a low carbohydrate diet 91% developed cirrhosis, whereas cirrhosis occurred in only 9% of those fed on white bread and potatoes.

Encephalitis in Rheumatism.

R. H. DOBLES AND J. DE SARAM (*The Journal of Pathology and Bacteriology*, May, 1938) describe the case of a girl, aged eight years, who was admitted to hospital with the characteristic symptoms of acute rheumatic fever with carditis. On the sixth day of the illness she suddenly became restless and incoherent, with delusions and hyperpyrexia. Within twelve hours she was comatose, and she died six hours later. The only findings at the examination of the central nervous system were a slight right external strabismus and the absence of the deep and superficial reflexes. Autopsy revealed recent rheumatic infection of the myocardium and valves, and an acute hæmorrhagic encephalitis. The hæmorrhages, which were scattered throughout the white matter of the cerebrum, cerebellum and pons, varied in diameter from one millimetre to two millimetres,

and were surrounded by foci of demyelination. The authors add that a similar case was reported by J. B. Alpers in 1928.

MORPHOLOGY.

Neurohypophysis in Man.

HENRY J. WADE (*Journal of Anatomy*, January, 1938) gives an account of the exogenous parts of the *pars nervosa* of the pituitary gland, or neurohypophysis; that is, of those cellular elements which have an origin outside the neurohypophysis and occasionally invade it. Detailed examination was made of 75 glands. The *pars intermedia* is present in man to a variable extent, and from these remains the basophile cells of the neurohypophysis are developed. Eosinophile cells of the adenohypophysis may be found very rarely in the neurohypophysis. This heterotopic finding is discussed. A new classification of the degrees of basophile invasion is described. More basophile cells were found in the male neurohypophysis. The basophilic invasion was seen at five sites and three levels in the neurohypophysis.

The Prostate Gland of the Rhesus Monkey.

S. ZUCKERMAN (*Journal of Anatomy*, January, 1938) states that two immature castrated male rhesus monkeys received daily injections of œstrone for a period of a year. The prostate glands of both animals were greatly increased in size by this treatment. The epithelium of the true prostatic tissue was unchanged, and hyperplasia and metaplasia took place only in the epithelium of the urethra, the *vagina masculina*, the terminal parts of the ejaculatory ducts, and the collecting ducts of the prostate gland. The nature of the prostatic growth induced by œstrone is analysed and is shown to consist mainly in growth of the utricular bed, the region intervening between the urethra and the glandular area. The occurrence of urethral diverticula is described and their presence is discussed in relation to the epithelial changes that occur under the influence of œstrone in structures that open into the urogenital sinus or urethra.

Terminations of Nerves in Human Teeth.

O. W. TIEGS (*Journal of Anatomy*, January, 1938) states that in a decalcified molar from a young human adult, stained by Bielschowsky's method, nerves have been seen in great numbers passing through the layer of odontoblast cells and entering the very narrow zone (subdentinal zone) between these and the calcified dentine. Here most of them run amongst the Tomes's fibres as very delicate and often highly branched fibrils. Sometimes, however, particularly in the crown of the tooth, fibres may fail to branch, and remain in association with the Tomes's fibres. In the crown, but not elsewhere, exceptionally coarse fibres have also been observed in the subdentinal zone. The nerves end on the Tomes's fibres by distinct end-organs, not unlike the *boutons terminaux* of the central nervous system. Sometimes a fibre may pass right through the subdentinal zone to the orifice of a dentinal tube, but such nerves have never been observed passing along the tubes; no evidence has therefore been obtained for the occurrence of nerves in the peripheral part of the dentine, which is said to be exceptionally sensitive. The anatomical arrangement is such as would be expected from Tomes's hypothesis that the fibres which bear his name conduct stimuli from the dentine to the nerves of the pulp.

Operations on the Hypothalamo-Hypophyseal Region of the Rabbit.

G. W. HARRIS AND G. T. POPA (*Journal of Anatomy*, January, 1938) give a description of a technique for operations on the hypothalamo-hypophyseal region of the rabbit. They also give a description of some experimental results (not functional) obtained by means of this operation.

Effects of Male Hormone on a Mature Castrated Rhesus Monkey.

S. ZUCKERMAN AND A. S. PARKES (*Journal of Anatomy*, January, 1938) state that male hormone (testosterone propionate prepared by partial synthesis) restored the atrophied accessory reproductive organs of a castrated mature male rhesus monkey to the normal size and functional condition. The animal also increased in weight during the course of the injections.

Elliot Smith and Neurology.

H. H. WOOLLARD (*Journal of Anatomy*, January, 1938) gives an outline of Elliot Smith's contributions to neurology. In summing up, the author states that the history of science shows that at times an ablerr mind handles a familiar problem and gets out of it so many fresh and novel ideas that the subject acquires a new interest and importance. Because he believes that Elliot Smith achieved this in neurology this paper was compiled.

Cultivation of Nerve Cells.

H. MEYER AND W. JABLONSKI (*Journal of Anatomy*, October, 1937) give an account of a series of experiments on the cultivation of spinal ganglia of chicken embryos over a long period of time. The oldest of the spinal ganglia cultivated survived in a sound state for nineteen weeks. No multiplication of ganglion cells was observed, and the ganglion cells did not migrate into the migration zone of the mesenchyme cells. In this, the cultivation of ganglion cells differed from the cultivation of other cell types. It was not possible, as it is with fibroblasts, to obtain a strain from a small number of cultures. It has been possible to make only a certain percentage of the explants survive. The silver preparations of spinal ganglia cultivated *in vitro* for as long as nineteen weeks showed that the ganglion cells and neurofibrillæ were in an excellent condition. Some of them resembled the material cultivated on cover-slips over a short period. In most of the older cultures, however, the shape of the cells differed considerably; the periphery was irregular, they had lobes, and sometimes very long and fine excrescences. These cells bore a great resemblance to those of the spinal ganglia of the large vertebrates.

Trophic Control by the Nervous System.

SARAH S. TOWER (*Journal of Comparative Neurology*, Volume LXVII, 1937) describes the atrophic and denervative changes which occur in muscle and bone innervated from an isolated and quiescent region of the spinal cord. By section of the posterior roots and transection of the cord above and below, the lumbo-sacral region of the spinal cord was isolated from incoming nerve impulses and rendered quiescent in three puppies, and these were kept alive for two, five and six months. The living animals, gross autopsy material and histological preparations were studied for evidence of growth and atrophy. The skeletal muscles atrophied and developed contractures. Microscopically, the fibres were reduced in all dimensions and their staining was pale, while some were in process of transformation into fibrous tissue; but innervation was largely intact. Interstitial fibrous tissue was increased. The bones were of normal length and general configuration, but deficient in thickness. Structures for the attachment of muscles were especially deficient. Four conclusions were reached: (i) that atrophy of disuse is a pathological entity in muscle, characterized by atrophy and metaplasia into fibrous tissue; (ii) that degeneration of nervous tissue within the muscle adds a further specific change, namely, nuclear proliferation; (iii) that the trophic control of muscle by the nervous system is complex, requiring both physical integrity of innervation and nervous activation; and (iv) that muscle action determines thickness and detail, but not length or form, in the post-natal development of bone.

Thalamo-Cortical Connexions.

W. A. WALLER AND R. W. BARRIS (*Journal of Comparative Neurology*, Volume LXVII, 1937) give an account of thalamo-cortical connexions based on experimental lesions of the cortex of the cerebrum of the cat. These lead to cell reactions in the thalamus, which can be revealed by the Nissl method.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Victorian Branch of the British Medical Association was held on May 18, 1938, at the Royal Melbourne Hospital. The meeting took the form of a series of clinical demonstrations by members of the honorary medical staff. Part of this report appeared in the issue of September 3, 1938.

Subdural Hæmatoma.

DR. A. E. COATES first showed a male patient, aged forty-five years, who had been admitted to hospital in June, 1937. His relatives stated that for one month he had had altered temperament, headache, vomiting and weakness in the right arm and leg. The patient could give no coherent account of himself. There was no history of trauma. Neurological examination revealed no definite localizing signs. He was considered to be suffering from a left frontal glioma.

Under local anæsthesia a fronto-temporal flap was turned down. A large organizing clot was found subdurally over the left frontal lobe, 10·0 centimetres (four inches) in diameter and 2·5 centimetres (one inch) thick. The centre was liquefied and contained dark fluid. The clot was removed by suction. The wall was greenish-yellow in colour and resembled rubber. The bone and flap were replaced, and drainage was provided. The patient at the time of the meeting was a foreman at the gas works. Dr. Coates said that the clot could have been removed by suction through one or two trephine holes; but the history and findings suggested a glioma. Hence a flap was cut.

Cerebral Meningioma.

Dr. Coates next showed a female patient, aged forty-two years, who had been admitted to hospital in May, 1938, with a history of headaches behind both eyes and of vomiting of fifteen years' duration. For twelve months she had had a tendency to fall, followed by paralysis of the left arm and leg. She had twitchings of the left big toe and left leg. Occasional loss of consciousness occurred, also attacks of precipitancy of micturition.

Examination revealed no papilœdema. There was paresis of the left arm and left leg. Lumbar puncture revealed normal cerebro-spinal fluid under a pressure of 230 milligrammes of water. Encephalography was carried out. Both ventricles were found to be pushed to the left; the right ventricle was deformed and pushed downwards.

Operation under local anæsthesia was performed on May 6, 1938. A large fronto-parietal flap was cut, extending across the middle line and exposing the sagittal sinus. A large meningioma was found attached to the longitudinal sinus situated behind and pressing upon the Rolandic area. Only a small part of the tumour was visible on the surface. It was embedded in the medial surface of the right cerebral hemisphere. After being separated from the brain it was rotated on its attachment to the longitudinal sinus and removed; and the hole in the sinus left after its removal was sewn over with fine silk. The pulse rate was 100 per minute and the systolic blood pressure was 110 millimetres of mercury at the end of the three hours' operation. Weakness in the arm persisted ten days after the operation, but the left leg was rapidly gaining power. At the time of the meeting the patient felt quite well, had no twitchings and no precipitancy of micturition.

Cystic Astrocytoma.

Dr. Coates next showed a male patient, aged forty years, who had been admitted to hospital in May, 1938, with a history of headache, failing eyesight, left-sided sensory and motor Jacksonian attacks and loss of power of concentration, of fourteen months' duration. He had recently had diplopia and numbness of the left hand and leg.

Examination revealed gross bilateral papilœdema of five diopters. Examination of the visual field revealed bitemporal hemianopsia. It was thought that this might result from pressure from the third ventricle. Complete left hemiparesis was present, and evidence of left parietal lobe involvement was found. Lumbar puncture revealed normal cerebro-spinal fluid under increased pressure. Ventriculography was carried out. A gross increase of pressure was revealed in the left ventricle, and the pressure in the right ventricle was 80 millimetres of water. X ray examination revealed a large left ventricle, pushed to the left, and a small right ventricle, pushed to the left.

Operation was performed on May 11, 1938, one week before the meeting. A right parietal flap was cut. A large cystic astrocytoma was found in the right parietal lobe. Sixty cubic centimetres (two ounces) of straw-coloured fluid were evacuated. The cyst was uncapped, the interior was explored, and a mural nodule was found anteriorly in relation to the *corona radiata*; consequently no attempt was made at removal. The patient's eyesight had improved and he had no headache. He felt well.

Trigeminal Neuralgia.

Dr. Coates's next patient was a woman, aged seventy-two years. She had had pain in the right side of the face, located behind the eye, of eight years' duration. Attacks occurred every few weeks, commencing suddenly and incapacitating her. The pain did not radiate. The sinuses, teeth *et cetera* were healthy.

The Gasserian ganglion was injected with absolute alcohol, the ophthalmic and maxillary portion being selected and the mandibular part of the ganglion being spared. The lids were sutured and the patient was referred to an ophthalmologist. She wore goggles with lateral shields when out of doors. She was completely relieved of pain and had no eye complications.

Dr. Coates remarked that the case illustrated the method of treating severe ciliary neuralgia by fractional injections into the Gasserian ganglion.

Another patient shown by Dr. Coates was a woman, aged seventy-four years, who had been admitted to hospital in December, 1937. For thirty-eight years she had had pain in the distribution of the trigeminal nerve, especially in the region of the nose and eyelids on the right side. Thirty-five years prior to her admission she had had the infraorbital branches of the fifth nerve removed and she was apparently relieved for twenty-five years, when the pain recurred.

For two years before her admission to hospital the pain had been more severe; and for two months before she obtained relief by injection, the pain had been excruciating and almost persistent, and the patient had been confined to bed. The pain was distributed over the right malar bone, but radiated as knife-like stabs to the right ear and down to the angle of the mandible, the right side of the upper lip and the angle of the mouth on the right side. In its most severe spasms the patient was unable to protrude her tongue or to close her jaws, for fear of commencing another excruciating knife-like stab. She had had all her teeth extracted many years earlier, without relief. During some of the less severe attacks rest in bed and sedatives had relieved the attack. The last attack, however, which was the most severe, failed to respond to morphine, and even chloroform did not prevent a recurrence of the attack after the patient had recovered from the anæsthetic. There was no obvious focus of infection; the antrum was investigated and found to be reasonably normal. An antrum wash-out in fact aggravated the patient's pain.

On January 13, 1938, alcohol was injected by the Härtel approach, only the maxillary and mandibular cells being destroyed. The ophthalmic portion of the Gasserian ganglion was spared. Herpes appeared about the mouth four days later, a sure sign of ganglion injection. Anæsthesia of the face had been produced in the distribution of the second and third divisions and relief from pain had persisted. Dr. Coates said that the patient had not felt so well for years.

Right Inguinal Hernia Repaired by the Wyllys Andrewes Method.

Dr. Coates then showed a male patient, aged fifty years. Six months before his admission to hospital he had experienced a severe dragging pain in the lower part of the abdomen and had noticed a swelling in the right groin. The swelling increased in size and was felt to pass into the scrotum, but disappeared when he lay down. He had had a similar condition thirty years earlier, which had been repaired by Bassini's operation in the Royal Melbourne Hospital, according to hospital records.

Examination revealed a large right-sided reducible inguinal hernia. On the left side a scar and a large external ring were present, with an impulse on coughing, although no sac was present outside the ring.

Operation was performed. The sac was excised and the hernia was repaired by the Wyllys Andrewes method, fine black silk being used to suture all layers of the aponeurosis behind the cord.

Dr. Coates remarked that the case demonstrated a method of repair of inguinal hernia in middle-aged workmen. After removal of the sac some repair of the weak posterior wall was advisable, as otherwise a potential direct hernia existed. The additions to the old Bassini operation, the reduplicated layers of external oblique aponeurosis behind the cord, the fine silk sutures, and the intact external ring through preservation of the intercrural fibres, had proved a valuable aid.

Progressive Muscular Atrophy.

DR. R. P. MCMEEKIN showed a female patient, aged forty-three years. She had had pleurisy twelve years earlier, and had undergone an operation for an ectopic pregnancy. She had two children, aged twenty-two and twenty-five years. She had had no miscarriages. Six months before her admission to hospital a steady ache commenced in the region of the left breast. At first it would come, last an hour and go; but later it became more severe and permanent. One week before her admission to hospital she suddenly became numb from the region of the breast down, lost her power of walking and to some extent her bladder and bowel control.

At the xiphisternum there was a level surrounding the body below which all forms of sensation were greatly reduced and below which power was slight. Knee jerks and ankle jerks were exaggerated, and an ankle clonus was present on the right side. The superficial abdominal reflexes were absent and the plantar reflexes were equivocal. Above the level there was some loss of sensation to cotton-wool, pin-prick, heat, cold and vibration. This applied also to the face and arms.

Lumbar puncture revealed fluid under a pressure of 40 millimetres of water, with no rise on jugular pressure; the fluid was slightly yellow. The fluid gave a strongly positive reaction to the Wassermann test. Another lumbar puncture, done a few days later, revealed very yellow fluid. Examination of the fluid revealed an increase in cells and protein content and the formation of a pedicle.

The patient was treated with mercury inunctions and with 19·5 grammes (30 grains) of potassium iodide three times a day for about three weeks. The power commenced to return and the pain disappeared. She was then given "Tryparsamide", first one gramme, then two grammes and finally three grammes, of which she had had three injections. After each injection she had some malaise; and after the third injection, in addition to having a severe headache, she was seeing double and seeing things in abnormal colours. Treatment with mercury and potassium iodide was then resumed.

For about two weeks she had been walking again with the assistance of the railing, and the sensory loss had greatly diminished. A further lumbar puncture revealed no block; there were fewer cells in the fluid and the protein content was much less. The cerebro-spinal fluid, when subjected to the Wassermann test, gave no response with the warm method and a strongly positive response with the ice-box method.

Polycystic Kidney Disease.

Dr. McMeekin's next patient was a female, aged forty-eight years. Her uterus and her right ovary had previously been removed. Her mother and uncle had died of pernicious anæmia. Her present illness was of two and a half years' duration. She first noticed a coldness and weakness of the right ankle, which would last two or three days and would occur weekly. Later the feeling extended up the leg to the hip and the other lower extremity became affected. Fibrillary tremors appeared. The condition advanced, and two years before the meeting her uterus and right ovary were removed, as it was thought that fibroid growths were pressing on the nerves in the pelvis. The power diminished until finally the only movement in the lower extremity was that of the toes of the right foot. As the power decreased the fibrillary tremors disappeared. For eighteen months she had been losing power in her back and arms, so that at the time of the meeting she could not sit up alone and could not raise her hands above her head. On examination a Reidel's lobe of the liver was to be felt. No sensory loss had occurred. The lower extremities were immobile, excepting for the toes of the right foot. The upper extremity was weak. The tendon reflexes were absent, except for the right triceps jerk, which was feeble. The superficial abdominal reflexes and the plantar reflexes could not be elicited. Fibrillary tremors could be seen in the triceps, trapezius and tongue.

The cerebro-spinal fluid was under normal pressure and was of normal constitution. The hæmoglobin value was 103%, and the blood film was normal.

A few days after her admission to hospital the patient developed retention of urine, which was successfully treated with "Esmodil". In a day she regained her bladder control.

Carcinoma of the Rectum.

DR. JULIAN SMITH, JUNIOR, showed seven patients to illustrate the various types of operation he had performed for carcinoma of the rectum. He thought that the perineal operation was pathologically unsound and inadequate, and he had been seeking a combined operation, compatible with low mortality, to overcome its shortcomings. Various methods of staging the operation had been advised. Having tried them all, he had come to the conclusion that a colostomy prior to a combined operation, whether in conjunction with other intra-abdominal manœuvres or not, did no more than provide drainage of the bowel. It did not shorten the second stage, removal of the rectum. In point of fact, it made it more difficult, and the operation therefore took longer. He believed that the outstanding principle in the treatment of the disease, and it was an obvious one, was that the patient should survive the operation performed for its cure. This principle should outweigh all other considerations. When the patient was a poor risk Dr. Smith was content to perform a perineal resection, with the hope that the growth might be one, as was often the case, which was slow to invade the glands or to produce metastases. Therefore, in planning the operation, he always paid more heed to the ability of the patient to withstand it than to the extent of the growth. Patients who were favourable operative risks were provided with a transverse colostomy, and then a one-stage perineo-abdominal resection was performed. The more debilitated patients were treated by a Lockhart-Mummery resection.

Dr. Smith said that he had not had a large experience of the disease, having had but twenty-eight patients under his care, ten of whom were inoperable and one of whom refused operation. Seventeen operations had been performed for eradication of the disease, with a rather high mortality of four. He was, however, somewhat comforted by the fact that in the last fifteen resections there had been two deaths only, which was an improvement on the general mortality of his small series. However, two of these patients had since died from metastases, one eighteen months and the other three years after operation.

Bronchial Infection.

DR. GEOFFREY A. PENINGTON showed a series of patients to illustrate some types of chronic bronchial infection. One patient had chronic bronchitis with gross sinusitis; the other three patients were suffering from bronchiectasis of different types and due to different pathological processes.

The first patient, a male, aged fourteen years, had reported at the Royal Melbourne Hospital on February 21, 1938, complaining that for some years a "stitch" below the right costal margin had developed at irregular intervals, but especially after any exertion which involved jolting. When present, the pain was aggravated by deep respiration. Quite irregularly he had suffered from a feeling of tightness about the chest, difficulty in breathing, and a cough. His appetite was poor; there was a history of nasal obstruction and nasal discharge. The past history was of little significance because there had been no serious illness; and although he had had measles and pertussis, the attacks were mild. His maternal grandmother had been asthmatic, otherwise the family history was clear.

He was a fairly well-developed boy, but rather pale; the nostrils were small and the nasal airway was obstructed. There was evidence of post-nasal discharge, and the tonsils were small and ragged. The boys' temperature was 37·8° C. (100·8° F.) and the pulse rate was 86 per minute. There was some impairment of the percussion note at the bases of the lungs; and numerous râles, rhonchi and soft crepitations were heard in these areas.

Investigation revealed gross maxillary sinusitis. Radiography revealed that the mucosa was thickened to such an extent that the air spaces were very small, and lavage proved that the ostia were blocked, and mucopus was obtained on lavage. Fluoroscopy revealed fair diaphragmatic excursion, normal appearance of the posterior part of the mediastinum and diminished translucency of a small area at the base of the right lung. In the skiagrams increased linear markings at the right base were seen; and a small area of partial consolidation, suggestive of a low-grade infection of recent origin, was seen anteriorly. No definite changes were seen at the base of the left lung.

The patient was subjected to repeated antral lavage and was given expectorants, with benefit. On March 21, 1938, X ray examination revealed the bases to be much clearer; but the linear markings were thickened at the base of the right lung.

In order to exclude bronchial dilatation, lipiodol was instilled into the bronchi on May 16, 1938. A normal bronchogram was obtained, which illustrated exceedingly well the manner in which the lipiodol spread as a thin film over the walls of normal bronchi without occluding the lumen.

Dr. Penington remarked that this patient illustrated the necessity for careful investigation, both clinical and radiological, in order that chronic bronchial infection and subsequent bronchiectasis might be prevented from developing. He proposed to endeavour to clear up the upper respiratory infection by surgical means if conservative measures were unavailing. The use of short-wave therapy and of deep X ray therapy in cases of chronic sinusitis was brought up for discussion.

Dr. Penington's second patient had early classical bronchiectasis involving the lower lobes of both lungs. Dr. Penington said that she showed the degree of damage which could exist without much evidence of disturbance of the general state of health, and the necessity for thorough investigation in every case of chronic cough. The patient had been referred as a sufferer from pulmonary tuberculosis. She was nineteen years of age, and had attended hospital first on April 14, 1938, because of a cough, which had been present since her birth. Her sputum was scanty, but was foul in odour; post-nasal discharge was profuse. She was fairly well developed, although rather thin, having lost five kilograms (eleven pounds) in weight. She was very nervous and apprehensive. Her chest moved poorly with respiration, especially at the right base; coarse râles, subcrepitant râles and crackling crepitations were audible at the bases, but were more pronounced on the left side. Breath sounds were diminished in intensity at the bases.

Investigation proved chronic sinusitis to be present. Radiological examination revealed pronounced thickening of the antral mucosa and diminished translucency of the ethmoid sinuses. Foul pus was obtained from the antra by lavage. Fluoroscopic examination revealed no abnormality of the posterior part of the mediastinum, but only moderate diaphragmatic excursion. An increase in the linear markings at both bases, with some reticulation on the right side, was seen in the skiagrams; the appearances were suggestive of bronchiectasis.

Dr. Penington said that lipiodol had not been instilled into the bronchi, owing to the patient's irregularity in attendance, but would be performed to obtain confirmatory evidence and for its therapeutic value. No tubercle bacilli were found in the sputum, which contained many streptococcal forms, some pneumococci and numerous small Gram-negative bacilli, probably *Bacillus influenzæ*. Dr. Penington proposed to continue with conservative measures in treating the bronchial condition; postural drainage, inhalations, so-called respiratory antiseptics, in the form of guaiacol and syrup of allium, and general and supportive measures would be used. The chronic sinusitis would be dealt with surgically, preferably under local anæsthesia.

Dr. Penington's third patient was suffering from bronchiectasis involving an atelectatic left lower lobe. She was a female, aged fifteen years, who attended on March 21, 1938, complaining of frequent colds and of a cough which had been present for about six years. She expectorated a moderately large amount of sputum, but did not feel ill in any way. There was a history of scarlatina, and of pertussis at the age of five years; but neither illness had been severe, and the patient said that she had never been really sick. She had had some previous antral treatment. An uncle suffered from tuberculosis.

Examination revealed a roughly triangular area of dulness to percussion at the base of the left lung, near the spine, and a diminution of breath sounds. A few coarse râles and rhonchi were faintly heard over the same area. The patient did not look ill, and there was no evidence of any other organic lesion.

Fluoroscopic examination of the chest revealed a rather poor diaphragmatic excursion and a diminished translucency at the left base. Skiagrams disclosed adhesions across the left costo-phrenic angle. Fibrosis was present in the left lower zone, with possible atelectasis of the left lower lobe. The heart and trachea were pulled to the left, and this was considered to be due in all probability to bronchiectasis. The right lung appeared to be normal.

Examination after injection of lipiodol into the bronchi revealed a contracted atelectatic left lower lobe with pronounced cylindrical bronchiectasis. The base of the upper lobe and the right lower lobe filled normally without evidence of dilatation. No tubercle bacilli were found in the sputum, and the patient was given postural exercises and drainage. These, with the aid of expectorants, appeared to have resulted in great improvement. At the time of the meeting practically no cough and very little sputum was present.

The pathology of this type of atelectasis was briefly discussed by Dr. Penington, who said that it was impossible to determine whether the condition was congenital in origin or a result of bronchial obstruction occurring during the attack of pertussis. In either case the end-result was the same, diffuse fibrosis scattered throughout the affected portion of the lung. It was intended to make further observation of the upper part of the respiratory tract, and bronchoscopy was considered by Dr. Penington to be a necessary procedure, so that the state of the bronchi and the efficiency of the postural drainage could be determined. Theoretically, he considered that this type of patient should be suitable for surgical treatment by lobectomy; but he pointed out that the lesion in these cases was usually of long duration, associated with dense adhesions and severe fibrosis, and the practical difficulty of surgical removal was great. This type of patient was often very

well in general health; and it did not appear justifiable to submit the patient to a severe operation in which the risk of troublesome hæmorrhage was considerable. He preferred to continue with conservative measures, unless there was great impairment of the health of the patient or evidence that a spread of the infection was likely to occur.

The last patient shown by Dr. Penington was a male, aged fifty-eight years, who had been referred to the hospital on January 21, 1938, with the history that he had suffered from acute pain in the right side of the chest five weeks previously. The pain had been aggravated by deep inspiration; he had a troublesome cough and expectorated a considerable amount of sputum. His medical attendant reported that there were signs of consolidation of the middle lobe of the right lung at that time; but there was very little febrile disturbance, and the condition did not generally resemble pneumonia. The patient's blood did not react to the Wassermann test.

Inquiry regarding his past history elicited the information that he had suffered from a similar attack some six or seven years previously and had then coughed up a large blood clot. Eleven months before coming to the hospital he had suffered from pleurisy on the right side. Skiagrams made at that time were said to be "suspicious".

Examination in January, 1938, confirmed the signs of some consolidation in the region of the right middle lobe. Dulness, diminished breath sounds, which were somewhat raised in pitch, and a few coarse crepitations and an occasional rhonchus were present. The patient appeared to be a sick man, and his temperature was 37·3° C. (99° F.). Fluoroscopic examination revealed fair diaphragmatic excursion, better on the left side than on the right. The transradiancy of the right middle lobe appeared to be impaired. By means of radiography appearances suggesting an unresolved consolidation were revealed. On March 8, 1938, some contraction of the area of dulness to be seen in the X ray films was found, but there appeared to be more diffuse involvement of the base of the right apical lobe. The clinical signs were quite unaltered.

Lipiodol was introduced into the bronchi on April 19, 1938, and radiographic examination revealed a saccular bronchiectasis of the right middle lobe. The upper lobe filled normally. There was no definite radiological evidence of sinusitis and no tubercle bacilli were seen in the sputum, so the patient was given general supportive treatment, iodide and creosote, and later garlic in the form of *syrupus allii* by mouth. He had steadily improved in his general state of health, the frequency of his cough, and the amount of sputum had rapidly decreased; and at the time of the meeting there was no cough and no sputum was being expectorated.

Dr. Penington said that this patient was shown as probably suffering from *bronchiectasis sicca*, of some years' duration. There appeared to have been a recent infection giving rise to symptoms, but the infection had been overcome. Dr. Penington pointed out that it was impossible to be certain of the duration of the condition, but the past history suggested that there had previously been periods of active infective processes giving rise to pain, cough and sputum. The history of a previous hæmoptysis was stressed as being of considerable importance in diagnosis, as this occurrence was sometimes the only clinical evidence of bronchiectasis which was readily demonstrable by radiography. The bronchial change was possibly secondary to fibrosis resulting from chronic inflammation of the right middle lobe; but this was considered an unlikely explanation. The question of surgical intervention was again worthy of consideration; but, as in the previous case, the patient felt so well and had such a minor degree of disturbance from the malady that Dr. Penington was very averse to urging the patient to submit to operation.

Coronary Disease.

DR. DOUGLAS THOMAS discussed coronary disease from various standpoints, using pathological specimens, skiagrams, kymograms and a series of patients to illustrate different aspects of the subject.

A series of hearts injected *post mortem* with barium-gelatine emulsions were shown. It was pointed out that coronary thrombosis was a comparatively infrequent event, and that the structural change which induced myocardial degeneration and infarction was essentially a progressive coronary arteriosclerosis with mural thickening. The great variation in the patterning of the areas of narrowing and in the subsequent disposition of the cardiac damage was traced in the mounted specimens.

Several X ray films of hearts, taken before and after the occurrence of proven coronary occlusion, were shown, and an endeavour was made to substantiate the view that coronary disease *per se* did not induce material change in cardiac and aortic outline, at least in ambulatory patients.

The difficulty in clinical diagnosis was discussed. It was recognized that cases were often encountered in which, on clinical grounds, the occurrence of coronary disease was suspected because of the presence of typical cardiac pain induced by effort, and in which straight radiography and electrocardiography revealed no abnormal findings.

Kymograms were shown exhibiting the changes in wave form occurring in some of these cases, such as reduction of the amplitude of ventricular contraction and the superimposition of secondary wave forms on the normal "mortise-chisel" pattern.

Patients, both hypertensive and with normal blood pressure, were shown, in whom coronary degeneration was considered to be present. Dr. Thomas said that generally the hypertensive patients were found to exhibit definite enlargement of the left ventricle in association with their angina of effort, whereas in the non-hypertensive cases no cardiac enlargement had occurred. One of these patients, a woman, aged fifty years, in whom gross hypertensive retinitis was present, had been admitted to hospital on more than one occasion with congestive heart failure. During her stay in hospital she had been singularly free from cardiac pain; but with recovery from such failure and the resumption of a more normal life her cardiac pain returned.

The frequency of occurrence of cardiac infarction on the left side of the heart was discussed, and the view was expressed that such frequency was adequately explained by the existence of a much greater quantity of muscle on the left side than on the right.

Dr. Thomas concluded by expressing gratitude to Dr. E. S. J. King for the assistance he had given in the preparation of the injected hearts used for the demonstration.

Intracranial Arteriography.

DR. E. GRAEME ROBERTSON showed three patients to demonstrate various points in connexion with intracranial arteriography.

The first patient was a female, aged twenty-five years. On June 19, 1935, the patient suffered from a subarachnoid hæmorrhage, the severe headache being relieved by evacuation of blood-stained cerebro-spinal fluid. Subsequently she suffered from intense pain behind the right eye, a throbbing noise in the head, dysæsthesiæ over the right side of the forehead, and diplopia. On examination complete paralysis of the third cranial nerve was found on the right side. Examination after injection of "Thorotrast" into the internal carotid artery by Dr. A. E. Coates revealed an aneurysmal sac growing from the site of bifurcation of the internal carotid artery. The latter artery was tied in the neck, but thirty-six hours later the patient became comatose and developed a left-sided hemiplegia. At the time of the meeting she was well, free from pain and able to walk, but she had gross hemiparesis.

Dr. Robertson's second patient was a male, aged thirty-six years. Since the age of twelve years he had suffered

from repeated attacks of pain behind the left eye, vomiting and vivid unformed visual hallucinosis. In these attacks the left pupil was always dilated. The attacks became so frequent that he was unable to work. Arteriography by Dr. Coates revealed what appeared to be an almost complete block of the internal carotid artery in the cavernous sinus. Since ligature of the artery the patient had had only mild headaches.

Dr. Robertson said that he believed that arteriography, as far as aneurysms were concerned, and operative treatment were useful only when the aneurysm was situated upon the internal carotid artery. He showed specimens and radiograms illustrating the reasons for the failure of arteriography to demonstrate the presence of aneurysms on or distal to the circle of Willis. He believed that, in spite of the high mortality, the patient was best served by conservative treatment in these cases.

The third patient shown by Dr. Robertson was a male, aged twenty years, who had always had a large head and who during the last twelve months had commenced to suffer from headache and failing vision. Radiographic examination of his skull revealed a dense, thin semicircle of calcification, with its concavity directed forwards 4·4 centimetres (one and three-quarter inches) above the *sella turcica* and 1·9 centimetres (three-quarters of an inch) behind it. An attempt to outline the cerebral ventricles by air introduced by the lumbar route filled only the fourth ventricle. The form of calcification suggested that it was in the wall of an aneurysm; but arteriography failed to confirm this.

Increasing intracranial pressure forced exploration, but no tumour was found. After death the gross hydrocephalus was found to be due to stenosis of the aqueduct of Sylvius. The calcification proved to be in the choroid plexus of the left lateral ventricle, as it lay stretched over the anterior wall of the trigonum. Alteration in the shape and position of the choroid plexus, produced by the hydrocephalus, resulted in a picture very different from the bilateral round shadows seen frequently in normal radiograms.

Chronic Inflammation of the Knee Joint.

DR. PAUL JONES showed a youth, aged seventeen years. Eight months earlier the patient had noticed that his right knee was swollen, and on attempting to bend it he felt a dull pain in it. He was able to walk about comfortably, but with a slight limp. There was no pain at rest and he was never disturbed at sleep by pains in the joint. The knee gradually became more swollen, more painful and less useful. His general health was good. There was no history of injury. In 1937 blotches developed over both legs, and he attended another hospital, where a diagnosis of rheumatic fever was made. He went to bed at home and the nodules disappeared within two weeks. He had no joint pains or swelling during this illness, and recovered completely. His mother suffered from indigestion and his father was well. He had two brothers, aged nineteen and fourteen years, who were quite healthy.

He had acne of the face. His teeth were in moderately good condition, his tonsils had been removed, and his heart, lungs and abdomen were normal. The right knee was swollen and deformed. The medial femoral condyle was prominent. The proximal end of the tibia was subluxated laterally and posteriorly. The skin over the joint was not altered in colour, but was warmer than that of the left knee. The patella was not freely mobile, and there was a very small range of movement. No demonstrable amount of fluid was present in the joint. Active movement was poor. He was unable to achieve full extension and had about 20° of flexion. X ray examination revealed loss of cartilage in the right knee joint, with marginal erosions of the articular surfaces of the tibia and femur, the erosions being fairly sharply cut and well defined. There was no loss of detail over the joint, and very little osteoporosis of the bones generally was noticed. The condition was thought to be chronic infective arthritis, possibly of tuberculous origin. There was no response to the Wassermann test. There was a strongly positive reaction to intradermal injection of old tuberculin (human) in a strength of 1 in 1,000. No fluid was obtained at puncture of the joint, but the capsule was thickened, and the synovial membrane was thickened and appeared like granulation tissue. The report on a section was that the lesion was a chronic inflammatory one and that no evidence of tuberculosis could be found.

König's Disease.

Dr. Jones's next patient was a boy, aged sixteen years, a mill hand. His left leg had been weaker than the right since an accident four years earlier. This weakness was most pronounced when he went up steps. Four weeks before the meeting he knocked the medial side of the knee against a post, and since then the knee had been weak and had given way on occasions. He was unable to extend the leg completely, and at times he actually felt the knee to lock. The joint was swollen, though not so much as it had previously been. On walking, which he did with a limp, he felt a pain in the back of the joint and on the medial side. His general health was otherwise good.

On examination the left knee was seen to be swollen, and fluid was found in the joint. The leg was held with slight flexion and could not be fully extended, but could be fully flexed. There was slight increase in lateral flexion. No crepitation was present. The knee was tender on deep pressure over the medial condyle.

X ray examination revealed an irregular area of rarefaction on the articular surface of the medial femoral condyle and a loose body in the intercondylar notch. The joint was otherwise normal.

In February, 1938, the joint was incised by an almost vertical cut between the internal lateral ligament and the patella. The synovial membrane was red and swollen and the joint contained a good deal of fluid. The space from which the cartilage had become detached was inspected and the fragment was found lying in the intercondylar fossa and was hooked forward. It was still attached posteriorly and the attachment was snipped away with scissors. The fragment was about the size of a half-crown, and section revealed dense fibrocartilage. Convalescence was uneventful. The patient was given post-operative physiotherapy.

(To be continued.)

NOMINATIONS AND ELECTIONS.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Sharland, Andrew Alexander, M.B., B.S., 1933 (Univ. Sydney), 98, Barker Road, Homebush.

Armati, Roy Edgar, M.B., B.S., 1937 (Univ. Sydney), The Gladstone, Gladstone Road, Leura.

The undermentioned have been elected members of the Victorian Branch of the British Medical Association:

Donald, Charles Stewart, M.B., B.S., 1936 (Univ. Melbourne), Warracknabeal.

Jones, Cyrus Arvon, M.B., B.S., 1937 (Univ. Melbourne), Alfred Hospital, Prahran, S.1.

Lavery, John Anthony Ernest Arthur, L. *et* L.Mid., R.C.P. *et* S. (Edinburgh), L.F.P.S. (Glasgow), 1895, Meeniyan, South Gippsland.

Proceedings of the Royal Commission Appointed to Inquire into Matters Pertaining to National Health Insurance.

The Royal Commission resumed sitting on Monday, September 5, 1938. A newspaper report of portion of the proceedings of September 2 was read by Mr. Abrahams. The Chairman agreed that the report was inaccurate.

The examination of Dr. E. A. Tivey was continued. Discussion ensued between counsel and the members of the Commission concerning the production of the replies to the *questionnaires*.

Mr. Abrahams stated that he would produce them if the Commission expressed the opinion that he should do so; but he objected to Mr. Dovey's using them to build something up in order to knock it down and to discredit the men who had furnished the replies. Mr. Dovey disclaimed any such intention. Mr. Abrahams pointed out that in many instances the replies were inaccurate and unreliable. Sir George Mason Allard suggested that they would hardly be suitable for tabulation purposes.

Sir George Mason Allard: You cannot have a reliable average without having accurate data to work on.

The Chairman: That consideration might affect the weight to be attached to the result, but the possibility of error is not sufficient to justify excluding that kind of evidence altogether. As a matter of fact, if we do exclude it we may find, when we come to make our decision, that we in turn will have to make blind shots. We may have no other material to work on.

Mr. Abrahams: We have a tabulation that took weeks to compile. I do not know whether it is of any use.

The Chairman: That is for you to decide. I myself think that any tabulation made honestly will probably possess some value. It would be open to comment and to testing. It may be that as a result of that testing it will turn out to be of little use, but it should not be rejected altogether.

Mr. Abrahams: Dr. Hugh Hunter has been for some time compiling a tabulation of the answers to *questionnaires* received from doctors in New South Wales. If the Commission thinks that that tabulation will be of any use it will be produced, and Dr. Hunter will be called to give evidence regarding it.

Dr. Mulvey: Are there many cases in which questions have been unanswered because of the inability of doctors to furnish figures regarding matters inquired into?

Mr. Abrahams: I understand that 3,400 *questionnaires* were sent out for the whole of Australia and about 700 were returned. Even in those returned many of the questions were not answered because of lack of information. All those we have will be produced, as well as the tabulation prepared by Dr. Hugh Hunter.

Dr. Mulvey: The position is that many doctors have not kept records which would enable them to answer the questions. It is only those with a good secretary or who are themselves good business men who have had the information.

Mr. Abrahams: In Melbourne there is an accountant who keeps the books of a great many doctors. He will be called. Also in Victoria a census has been prepared of friendly society members, which should be of assistance to the Commission. There is no attempt on our part to keep anything back from the Commission. As a matter of fact, the answers to *questionnaires* support the income figure which I stated the other day, and there is a surprising unanimity regarding the figure throughout the whole of Australia, at any rate to within £100.

Dr. Mulvey: I understand that the witnesses whom you have called are those who kept good books; that they were not selected witnesses to suit your case.

Mr. Abrahams: That is so; but we are prepared to call any witnesses whom my friend wishes to have called. Naturally we called those who had books to support their statements, but we shall call the guessers too if required.

Dr. Mulvey: Some of the questions would be very difficult to answer. For instance, there is the question which asks for the number of contract patients and dependants attended at the surgery and at the home.

Mr. Abrahams: I admit that. It has proved difficult even for those witnesses who have been called.

Dr. Tivey stated, *inter alia*, that in lodge practice he found that the proportion of excluded services to included services was as one is to eight.

Dr. Edward Connolly was examined. He stated that he had had experience in England, acting as *locum tenens* in London and in Yorkshire, Gloucestershire and Leicestershire.

Mr. Gain: I understand that you have given some thought to the figures given by the Ministry for Health in that inquiry in 1936, when it was alleged that the maximum was about seven attendances per panel patient, the maximum panel being 2,500, and that there could not be more than 17,500 attendances a year. I understand you have given some thought to that, and you challenge that estimate?

A.: Yes, I do not agree with the estimate for several reasons.

Q.: Will you tell this Commission some of the reasons that make you think they are too low?

A.: In the first place the system under which the figures were collected, and secondly, the figures I have actually seen myself. . . . A card was sent round to each panel doctor, on which he had to record each day the number of services, visits, consultations given to each panel patient. Under those circumstances, in a busy practice, there was so much to do otherwise that the doctor used to forget making some entries.

The Chairman: You say that a card was sent round for the purpose of gathering information as to the number of attendances, and you were about to say something to the effect that the practitioner was too busy. What happened then concerning the card he was asked to fill in?

A.: In the first place there was a limited number of men who made a return, and in the second place the returns made were not accurate; they were never near the maximum I saw.

Mr. Gain: Have you had any experience as to the extent to which the dependants of panel patients become private patients?

A.: I found that you uncommonly got the dependants of panel patients as private patients; they usually went to a hospital, to the out-patients' department, for treatment. They seemed to think that if one member of the family had paid for medical treatment that was sufficient to pay for the whole family, and they used to go elsewhere.

Q.: Did you find any tendency on the part of panel patients to consult you unnecessarily?

A.: Oh, yes. I think that the actual service was far in excess of the needs of the panel patients themselves. They used to come along with quite unnecessary complaints and take up your time.

Q.: Is there not a regulation designed to check that kind of thing?

A.: It could be stopped by a report by the doctor; but the trouble about that is that as they come several times a day with trivial things, if a man reported every complaint he had, he would have no practice at the end of a few weeks. It actually does not protect the doctor at all.

Q.: What about the panel patients themselves in respect of matters that do not come under the panel service?

A.: There are two reasons why you do not treat them for extras. The first is that they will not pay for the extras—they prefer to go into hospital and have it done; and in the second place you have no time to do extras with an ordinary average panel.

Comparing the English panel system with the Australian contract system, Dr. Connolly said that under the contract system the medical man had more time to give extra services himself instead of sending the patients to hospitals. Dr. Connolly also made reference to the difference in repute and standing between panel practitioners and private practitioners.

The Chairman: So far as I am concerned, it may be taken that I am not going to pay any attention to the suggestions of difference of social standing between the future insurance practitioner and the general practitioner in Australia. I say that while recognising that it may be that there will gradually tend to develop a different sort of estimation in the community for the man who does nothing else, or practically nothing else, except insurance work, and the man who has an extensive private practice. That is bound to develop.

Dr. Connolly was then cross-examined by Mr. Dovey, mainly as to the conditions of panel practice in England.

Dr. Rupert Sheldon was recalled and further examined concerning panel practice in England, and was later further examined *in camera*.

The Commission adjourned at 4.35 p.m. until Tuesday, September 6, 1938, at 10.30 a.m.

Tuesday, September 6, 1938.

Mr. Robert Neil Cadwallader, an accountant in the employ of Messrs. Allard, Way and Hardie, who had been assisting Mr. Dovey, was examined by Mr. Abrahams and Mr. Dovey. It was arranged that Mr. Cadwallader should be at liberty to interview medical witnesses and to question them as to how they arrived at the figures they gave for the various services. Mr. Cadwallader has been given the task of checking the figures put forward by various medical witnesses. Mr. Abrahams stated: "I shall make them available to him to interview them about their books, as I have already done, and shall endeavour in advance to have them come prepared, so far as they are able, with the total of the excluded services and the excluded amount in the aggregate. If the witness wants the details he must get them from interviews."

Dr. Carl Herman Jaede, Mascot, who had been previously examined *in camera*, was recalled and further examined in open court. He stated that his excluded services for lodge patients, in which he included midwifery, fractures, operations and other excluded services, amounted to 10s. 6d. per member for 1936-1937. He estimated that a lodge member represented 2·5 patients.

The remainder of Dr. Jaede's examination was *in camera*.

The Commission adjourned at 4.35 p.m. until Wednesday, September 7, 1938, at 10.30 a.m.

Wednesday, September 7, 1938.

Dr. Richard Hilliard, of Dee Why, was examined in open court. From 1920 to 1928 he stated that he had had a panel practice with a list of 2,500, at Normanton, in a coal-mining area in Yorkshire. For these 2,500 patients he received about £1,125 *per annum*; in addition he had a large private practice.

Mr. Gain: Will you tell the Commission the scale of fees you charged in your private practice?

A.: Private certificates averaged 6d. each. I used to visit almost everybody for 3s. 6d. and provide medicine. Night visits were charged at 7s. with medicine. A few better-class patients I visited for 5s. with medicine, and 10s. with medicine for a night visit.

Mr. Dovey: What do you call a night visit?

A.: Any time between 8 p.m. and 8 a.m. In the surgery I saw the babies for 1s. 6d. with medicine, if they paid cash; if they did not pay cash I booked it at 2s. and sent a bill. For young adults, roughly between fourteen and eighteen years, the fee was 2s. 6d. for consultation with medicine, cash, and 3s. if I had to book it and send them a bill. For adults the charge was 3s. cash with medicine, and 3s. 6d. with medicine if I had to book it and send a bill.

Mr. Bowie Wilson: That is a booking fee of 6d. all round?

A.: Yes.

Dr. Hilliard stated that he got practically nothing from panel patients by way of extras; he did no surgery, as he had no time for it. In the winter period, roughly from October to the end of March, he never visited less than 35 patients in a day, and had visited as many as 80 in a day. In the surgery during six hours, three in the morning and three in the evening, he would see anything from 60 to 100 patients. He found it necessary to be an expert in snap diagnosis, and he found that contract practice in Australia was very much easier than panel practice in England, as there was an absence of red tape, the patients were easier to deal with, and more time could be devoted to diagnosis. He found the red tape under the English panel system very irksome, especially as to certificates and prescriptions. There was no difficulty in getting patients into hospital.

Mr. Gain: Did you form any opinion as to the effect of the panel system on the outlook of the panel patients?

A.: I think that from the doctor's viewpoint, in those large industrial districts, it demoralizes them; they feel that they have a right to go to the panel doctor, and they go regardless; whereas with the lodges here the members of the lodges attend their local lodge meetings and are proud of their lodge doctor. Very often he has operated upon them or their wives. They also see that he is not taken advantage of. At their monthly meetings, if they find that Tom, Dick or Harry is putting it over the doctor they give him a polite hint to cut it out and go more lightly on the medical side of the lodge.

Q.: You find your lodge patients very considerate?

A.: Very considerate; always have done.

Q.: What did you find was the effect of the panel practice on the health of not only yourself, but also the other doctors?

A.: They were a tough crowd of Yorkshiremen. I was a Londoner and was not temperamentally fitted for it. It practically broke me; I have never really recovered.

Q.: What about your partner?

A.: He could not stand it and I had to buy him out. He too came from London.

Q.: What holidays did you take?

A.: Just before the beginning of the winter, in order to get ready for the winter, I used to take a fortnight. I used to take a fortnight when the winter was over, and I nearly always managed to take a full month in the summer. I could not carry on otherwise. At the end of my period there I had to take an assistant for eight weeks in the winter. Then I sold out.

Cross-examined by Mr. Dovey, Dr. Hilliard gave the cost of the practice he purchased as £2,000, a year's purchase being the usual price in the district. The figure of £1,125, being income from the panel practice, was arrived at by multiplying 11s. by 1,900 patients. Later the panel dropped from 11s. to 9s. Roughly speaking, there were about as many services per person for the private as for the panel patients. He did all his own dispensing, which occupied a considerable amount of his time. After further cross-examination by Mr. Dovey and Mr. Williams, Dr. Hilliard withdrew.

There followed discussion at considerable length as to number 6 of the terms of reference. The matter was brought up by Mr. Abrahams, who desired a pronouncement by the Commission as to the basis of inquiry under that term. The question was debated between the Commission, Mr. Abrahams, Mr. Dovey and Mr. Williams; but the matter was finally left open, Mr. Dovey stating that he would endeavour to obtain further information regarding what was meant by the particular term of reference.

Dr. Robert James Jackson, Armidale, the Honorary Secretary of the Northern District Medical Association, was examined. He stated that after conferring with other practitioners in the district he had formed the opinion that the practice of his profession would be rendered almost impossible, having regard to reasonable comfort and efficiency, if the mileage provisions suggested by the National Insurance Commission were adopted. Examined by Mr. Abrahams as to mileage fees in the district, he stated that they varied from 5s. a mile over two miles for lodge patients to 7s. 6d. and 10s. 6d. a mile over two

miles for private patients, in day time and at night respectively.

The Northern Districts Medical Association's schedule of minimum fees was tendered as a confidential exhibit.

Mr. Abrahams: What happens in the case of lodge patients or private patients who cannot afford this mileage fee?

A.: The patient usually comes in. If he feels he cannot afford the fee, he usually sees to it that he is brought in to the doctor.

Q.: Suppose he is ten miles away?

A.: He usually sees that he is brought in unless he has money to pay or unless there is a good will between the doctor and the patient. In that case he may say: "I cannot pay you now, but will do so later." Then the amount is allowed to stand over until such time as he can pay.

Q.: If a man has a severe gastric pain I suppose he will come in in his employer's car or sulky, or in the ambulance?

A.: Yes.

Q.: What have you say about the the scheme under which the Government will pay 2s. a mile one way over three miles, the Government paying in respect of every panel patient?

A.: My fear, and it is shared by all the doctors practising in my district, is that those patients who now see to it that they are brought in will call the doctor out to them night or day.

Mr. Dovey: Whether it is necessary or not?

A.: They will think it necessary, of course. We believe that they will not call us unless they think it necessary; but if the patient has a pain he will probably believe that he needs medical attention, whereas the doctor may know that it is not urgent.

Mr. Abrahams: Especially at 2 o'clock in the morning, when the temperature is low?

A.: Yes, when it is snowing perhaps. They will be paying their contribution to the insurance fund, and they will feel that they have the right to bring the doctor out when they know the doctor is being paid for it by the Government.

Mr. Abrahams: Your Association passed a resolution to be forwarded to the New South Wales State National Health Committee in these words:

> That if a National Health Insurance scheme is proceeded with, we insist that mileage shall be at the rate of 5s. per mile beyond two miles.

Is that correct?

A.: Yes.

Q.: That is the present rate under contract practice for day time, and 7s. 6d. for night under contract?

A.: Yes.

Q.: The proposal is that you find out how many of those people live beyond three miles and the doctor is paid for those whether he attends them or not. Is it your view that that is a good system or not?

A.: It is my view that from the doctor's point of view it is a very bad system, and we would desire that we be paid per visit to the patient and not so much *per annum*.

The Chairman: By whom?

A.: We are not concerned very much by whom; but we do feel that if a patient paid part of it it will be better for us than if the Government were to pay the whole of it.

Mr. Dovey: Why?

A.: It is then a deterrent upon the patient in summoning the doctor unnecessarily.

Mr. Abrahams: And if the Government pays the lot it is felt that the Government will see that there are no unnecessary calls?

A.: That is our viewpoint, that the Government then through its officials will see that unnecessary calls are not made.

Q.: But you prefer, if possible, that the patient should pay some of it?

A.: Yes.

Q.: You know which are the included services and which are the excluded services under national health insurance?

A.: Yes.

Q.: Excluded services consist of confinements, fractures, anæsthetics, operations *et cetera*?

A.: Yes.

Q.: Have you considered the question of the amount per service which is received for the excluded service and the included service respectively?

A.: Yes.

Q.: For which do you think you receive per service, that is more money, if there is any difference?

A.: In my estimate the amounts are approximately the same per service.

Q.: What about the time per service spent on excluded and included services?

A.: In my experience the time spent on the included service is a little greater than on the excluded service per service.

Dr. Jackson was cross-examined by Mr. Dovey.

Mr. Dovey: In respect of the resolution which you have told us was carried and, I understood you to say, expresses the opinion of all the members of the association—"That if a national health insurance scheme is persisted with, we insist that the mileage shall be at the rate of 5s. a mile"—may I take it that the attitude of your association is that unless such a provision is made in the contract of service your people will not entertain the scheme?

A.: Oh, no. I should like to say that our men in the north are prepared to cooperate in this scheme. We are not taking up a hypercritical attitude of the Government's proposals. For a number of years we have considered the probability of the introduction of national insurance and have taken a sympathetic view.

Q.: What do you say as to the word "insist"?

The Chairman: It may be merely an unfortunate word.

Mr. Dovey: I want to know what the position is. One reads in the Press that some Branches have said that they will have nothing whatever to do with this scheme. If that be so, and if that be the opinion of the members of the Association, of what value is the evidence? It may be of some value, but I suggest that it will be of considerably less value than the evidence of those witnesses who are genuinely anxious to participate in the scheme. If it be the opinion of a witness, as a member of an association or otherwise, or if it be his intention not to take any part in such a scheme, it will be his desire to cripple the scheme.

The Chairman: I am inclined to agree that if a witness is hostile to the idea of national insurance, any evidence that he gives in regard to such matters as we have to deal with may be to some extent discredited because of that hostility. This witness has said that he is not hostile and that his association has been rather sympathetic.

Further cross-examined by Mr. Dovey on the mileage question, Dr. Jackson said that not many of his lodge patients lived beyond three miles, but that he had been called out fifty miles or more to private patients. He agreed that these patients would not come under the national health insurance scheme and that it was rare to be called out any long distance.

Mr. Dovey: Do you appreciate that there will be no obligation on you to visit that patient at his home under the national health insurance scheme unless in your opinion that visit is necessary?

A.: There are no means of determining that. If you are called at 3 o'clock in the morning and Mr. Jones, fifteen miles out, is reported to have a very severe pain in the back, it is the doctor's obligation, unless he is quite certain that his condition will not suffer by delay in seeing the patient, to see him.

Q.: I suppose that ordinarily the doctor would ask a few questions to ascertain whether it was not merely a pain in the back?

A.: Quite frequently in the country a message comes not from the patient's home, but three or four miles away;

it is sent by messenger, and the message is: "Mr. Jones is very sick; could you come out to see him?" You have no means of finding out exactly what are the symptoms.

Dr. Jackson also agreed that it was the exception rather than the rule to be called out unnecessarily to a patient, private or lodge, even within the three-mile limit.

Mr. Dovey: You do not anticipate, do you, that the insurance patient in his mentality and outlook will be any different from the lodge patient?

A.: My fellow practitioners and I think that the man in the country, some distance out, will find it very much easier to get the doctor out in the middle of the night than to go to the trouble of getting somebody else's car to bring him in or getting some other way of getting in, because it costs you nothing and he knows that he has paid 1s. 6d. a week for the service.

Q.: You do not think he is going to know anything about the right to call the doctor out?

A.: Oh, yes, they know all about these things.

Q.: Of course, if he were liable to pay a mileage fee when his condition did not in fact warrant a visit to his home, your objection, I suppose, would be reduced?

A.: No, we do not take the view that we want to make money out of these people, but we do take the view that we want to safeguard ourselves against the possibility of these unnecessary, exhausting calls.

Q.: You are making your proposal as to mileage on the assumption that an insurance patient will treat you differently from a lodge patient?

A.: Yes.

Q.: And that his employer will treat him differently in the future?

A.: No, the employer will still treat him the same, we think.

Q.: You do not expect that the employer will be niggardly or any less generous than he is at present in his treatment of his employee?

A.: My fellow practitioners and I think that there will be the tendency for the employer to say: "Why should I go to the trouble of getting out of bed to take you in my car when you can get the doctor out?"

Q.: Assuming that insured persons behaved in the future as lodge patients have behaved in the past, would you still think it inadequate?

A.: No.

On the conclusion of his cross-examination Dr. Jackson was further examined *in camera*.

The Commission adjourned at 4.30 p.m. until Thursday, September 8, 1938, at 10.30 a.m.

Thursday, September 8, 1938.

Mr. Dovey: In respect of the matter discussed yesterday—the manner in which terms of reference number 6 should be approached—since the adjournment I have been in touch with Canberra and have been told that an authoritative communication through the proper channel will be furnished to the Commission, it is hoped early next week.

The Chairman: The Commission would like Mr. Williams to furnish as soon as possible what he suggests on behalf of the societies should be the standard they recommend.

Dr. Vivian Roy Elphick, Lake Cargelligo, was examined. The roads in the district he described as uniformly bad, with the exception of the main roads to Condobolin and Wyalong. Wyalong was 76 miles east, Condobolin 60 miles north-east, Griffith 70 miles south, Hillston 60 miles west. On the north it was open country, with Cobar about 100 miles distant. He had to attend patients approximately half-way to any of those towns. He gave descriptions of the roads and difficulties in travelling, and of the heavy upkeep on his car. He gave twenty miles as the average distance he had to travel on visits outside the township.

Mr. Gain: What is your view as to the position in regard to visiting under national health insurance?

A.: Personally, I view the matter with grave concern. Calls in the day time take you away from your practice. We do not want calls in the country. When you go, you have to make up the time lost when you come back. You find people waiting in the surgery. Very often you get indigestion because you have not sufficient time for meals. Your work is carried on into the night. Night calls we view with even more disfavour. We find that our chief asset in life is sleep, and if that is broken into it interferes with your work, not only at the time, but also next day. If one is called out at, say, midnight or one o'clock in the morning, one is very lucky if one can get to sleep inside an hour or two after returning to bed. The patient he sees does not get a fair deal, because, being awakened out of sleep, the doctor is not in a fit condition to diagnose an intricate case, which would probably be the nature of the diagnosis if he is called out at night. Next day you do not feel inclined to work and the community in general suffers because you are not in a fit state to attend to them. I have had a good deal of experience and am honestly greatly afraid of people having the right to call us out at any time.

Q.: At present six of your lodge families live outside the town?

A.: Yes.

Q.: In the last fourteen years you have paid only four visits to those lodge patients?

A.: Yes.

Q.: You attribute that to the fact that you always charge mileage to people outside?

A.: Yes, that is the main reason. If they know that mileage is being charged they will always come in.

Q.: The suggestion has been put before this Royal Commission by the Insurance Commission that you be allowed mileage at the rate of 2s. a mile one way over three miles, on the basis of one visit to each panel patient *per annum*. In your opinion, would that be adequate?

A.: No, I am sure it would not as far as I am concerned.

Q.: Do you find that, being the only doctor in the town, your position is affected as far as responsibility is concerned?

A.: Yes, it is very difficult if one is in doubt or worried about a case to get a consultation. One could only get it by telephone or at great expense. The responsibility is greater than that which devolves on practitioners in the town where there are two or three. If a case came to a doctor he could not send 60 or 90 miles for a consultation. He has to carry out many more investigations which in any other town would be delegated to someone else—to a specialist. If any X ray is needed, we have to do that. Similarly with a blood count. We cannot send away for those things. Our investigations take longer than in more populated areas.

Mr. Dovey: Mr. Lindsay tells me that these special difficulties spoken of by the doctor justify some extra payment for mileage. The Commission proposes that the normal rate of mileage in country districts should cover special cases, such as the one spoken of by the doctor, which I think the doctor will agree are exceptional, having regard to the number of practitioners even in country districts. The doctor's district is very sparsely settled; you may go miles without seeing a habitation. It is not contemplated that normal rates should apply to exceptional cases.

The Chairman: That may get over the difficulty as to remuneration, but not as to needless calls, which, I take it, is one of the matters of which you are afraid, doctor?

A.: Yes, Your Honour.

Mr. Dovey: If there were needless calls, there would be trouble. Your Honour will remember that another medical practitioner practising in the country said that if insured persons treated their doctor in the same way as they are treated by friendly society patients at the present time, the mileage rate would be adequate.

The Chairman: In the case of friendly society patients there has always been the deterrent of an extra personal charge on the patient.

Mr. Dovey: Which was sometimes collected and sometimes not. One realizes that there is that difficulty. Mr.

Brigden, in paragraph 88 at page 20 of his printed evidence, says: "The system will not be confined to rural areas, and in certain districts where travelling is particularly difficult or costly, the Commissioners may provide a special subsidy to assist the local practitioner."

Mr. Dovey: This is a matter of importance, and we propose to ask the Insurance Commissioners how they intend to meet the situation.

Dr. Mulvey: The conditions described by the witness are typical of a great many country practices, in the mountains and tablelands, without going into the far west at all.

Mr. Dovey: I agree that they might apply to, say, Dubbo.

Dr. Mulvey: You do not need to go as far as that; conditions at Oberon, for instance, are much the same. The roads are as bad and the nearest doctor is thirty miles away.

Mr. Dovey: I had in mind particularly the greater distances to be travelled in the west.

Dr. Mulvey: There is no doctor between Oberon and Goulburn, as far as I know, and a doctor is quite likely to receive a call to a place forty-five miles away. I consider that the conditions which the witness describes are typical rather than exceptional for country areas.

Mr. Dovey: Probably more than three-quarters of the population of New South Wales is east of the Dividing Range and a few miles over the western side down towards the Victorian border, which leaves less than a quarter of the population spread over three-quarters of the area. That is what I meant by saying that the conditions described by the witness are exceptional, in that they apply to only a small proportion of the population.

Dr. Elphick was cross-examined by Mr. Dovey and then gave further evidence *in camera*.

Dr. Carl Russell Furner, of Islington, a suburb of Newcastle, was examined. He stated that he practised in an industrial and suburban area. His patients were iron and steel workers and shop assistants; there were no miners. He was lodge medical officer to about forty friendly societies, receiving a capitation fee of 36s. a member *per annum*. From inquiries made of 1,000 members he determined 2·7 as the number of persons each member represented, including the member.

Mr. Gain: You have formed certain opinions as to the time required for service to treat patients now as compared with, say, ten years ago; and you believe that any fee fixed now by the Commission may not necessarily be applicable in five years' time, because the time required per service may by then have increased still more?

A.: Yes.

The Chairman: That is to say, you have a gradually increasing load of work to carry?

Mr. Gain: Yes, because of the advance of medical science. Will you explain what you have in mind?

A.: I feel that, year by year, the number of investigations involved in the examination of each patient is increasing. Take a headache for instance, which is quite a common ailment. I now use four more instruments in the examination of a patient suffering from headache than I did ten years ago, and I can see that in the future the time taken to investigate each patient will probably increase. The assumption is that, to earn the same income, a doctor will need to be paid more if he is to spend the same length of time investigating each patient thoroughly. . . . I believe that the Government, in fixing the fees, should ensure that the standard of service does not deteriorate through the doctor having to attend to more patients in the same time. If the Government is going to alter medical practice, let it not take a retrograde step.

Dr. Furner was then cross-examined by Mr. Dovey, mainly as to the conditions of his lodge practice.

Mr. Dovey: You said that mileage does not trouble you in your practice at all?

A.: Not for any practical value.

Q.: Do you find with these people who pay you at *per annum*, that they give you a fair deal and do not call upon you unnecessarily?

A.: Yes, I have a great affection for them; they treat me very reasonably.

Q.: Not only the men themselves, but also their dependants?

A.: Yes, they are very considerate.

Q.: Although they know that you are at their beck and call whenever you are asked to come?

A.: Yes, and although they know we do not charge a night fee.

Q.: They know you do not trade on them and they do not trade on you?

A.: I do not know what they think of me.

Mr. Gain: You know the scope of the included services under national insurance and the scope of the excluded services?

A.: Yes.

Q.: Can you give an opinion as to the time per service which would be taken, all in all, for the excluded service as compared with the time, all in all, for the included service?

A.: My opinion, for which I have really no data, is that it would be about equal—that an excluded service would not take longer than an included service.

Dr. William Wallace Cameron, Mudgee, was examined *in camera*.

The Commission adjourned at 4.35 p.m. until 10.30 a.m. on Friday, September 9, 1938.

Friday, September 9, 1938.

When proceedings commenced, discussion took place as to the inquiries that had been made as to the extent of the reference in term number 6, and then Mr. Abrahams raised questions as to whether Mr. Cadwallader, the accountant assisting the Crown, would make available to him progress reports concerning the work which he was doing. Mr. Cadwallader was engaged in extracting information from and checking the books of the medical practitioners who had given evidence and was endeavouring to tabulate the information so gained. It was arranged that as soon as Mr. Dovey and Mr. Cadwallader knew what was going to be said about a particular book, Mr. Abrahams was to be given a statement in advance in order that he could, if he so desired, check the figures and conclusions to be put forward by Mr. Cadwallader.

The examination of Dr. W. W. Cameron was continued in open court. He was cross-examined by Mr. Dovey as to the figures in his return and as to the towns from which people came to him as patients.

Mr. Dovey: All those places you mention have resident medical practitioners?

A.: No, only a few of them. A lot of those people who come to me from those districts are of the classes which will come under national health insurance. Those people will be definitely lost to me.

Mr. Abrahams: You will not be able to make up the full panel of 1,001 provided for?

A.: Definitely not.

The Chairman: I have no doubt that some medical men will lose patients who are attached to them, so to speak, by some personal attribute, but other men will gain correspondingly.

Dr. Cameron was then cross-examined concerning the estimate which he made, that 33⅓% of his patients would come under national health insurance. It was mentioned by Mr. Dovey that under national health insurance there was nothing to prevent a doctor from having a patient on his list even though there would be a doctor nearer to him, but that such a doctor would get mileage fees only in respect of the distance to the nearest medical officer.

After further examination concerning the figures in his return, Dr. Cameron withdrew.

The Commission adjourned at 12.30 p.m. until 2.30 p.m. on Tuesday, September 13, 1938, at Brisbane.

National Health Insurance.

BORDER MEDICAL ASSOCIATION.

A SPECIAL general meeting of the Border Medical Association was held at Albury on August 21, 1938. There were nineteen members present.

The following resolutions were carried:

I. That each member hereby pledge himself to refuse to accept service under any national health insurance scheme controlled by government, and to be bound by this pledge until and unless after application to this local association, special permission is granted to him to resume his personal freedom of action.

II. That a campaign to all neighbouring associations in New South Wales and Victoria be commenced immediately, urging them to take similar action.

Analytical Department.

"GLYX DIABETIC LOAF".

"GLYX DIABETIC LOAF" is a product of B. Addison and Company, and is manufactured by three different bakers in Sydney. The loaf is described as containing "29 parts *per centum* of protein and not more than 19 parts *per centum* of carbohydrates present in the form of starch and/or water-soluble carbohydrates". A sample was submitted to our analyst, who reports as follows:

The sample of "Glyx Diabetic Bread" as received by me was somewhat stale and rather dry, except in the centre. The loaf had a very open texture, but under the circumstances it was not possible to determine its palatability. The loaf resembles a very open texture brown loaf.

Analysis gave:

Protein	44·2%
Fat	11·9%
Ash	2·8%
Moisture	17·4%
Fibre	1·9%
Carbohydrates by difference	21·8%

For comparison with the analysis submitted by the manufacturers the figures for a dry basis are given for each:

	This Analysis.	Manufacturers' Analysis.
Protein	53·5%	47·6%
Fat	14·4%	14·4%
Ash	3·4%	4·3%
Fibre	2·3%	3·4%
Carbohydrate	26·4%	30·3%

The loaf evidently contains soya bean flour and not all the carbohydrate is starch.

It will be noted that the sample examined by our analyst was dry. If it had been fresh it is reasonable to assume that the percentage of carbohydrate in the first analysis would have been lower.

Each loaf is wrapped before being dispatched for sale. An inspection of the bakeries concerned revealed that it was manufactured under hygienic conditions. The bread is attractive in appearance and agreeable to the palate. It can be recommended for use when bread with a low carbohydrate and high fat and protein content is required.

Correspondence.

TOXIC GOITRE, WITH SPECIAL REFERENCE TO END-RESULTS.

SIR: May I give some facts supporting Dr. Sandes's article in THE MEDICAL JOURNAL OF AUSTRALIA of September 3, 1938.

Radiation therapy of toxic goitre had been inaugurated by Mayo and Williams in 1904. Very extensive and exact statistics have been since published from clinics where surgical treatment certainly could not be regarded as poor.

Soiland (Los Angeles) reports the result of radiation therapy in exophthalmic or toxic goitre in 5,400 cases: 73% cured, 16% improved, 11% not cured. Forsell (Stockholm), in his survey of experiences at Radiumhemmet of Röntgen treatment of exophthalmic goitre, reports 53% cured, 32% improved. In this number are 25% of grave cases. Pfahler (Philadelphia) treated 200 cases, of which only in three cases operation afterwards was necessary. Sielman (Munich) has the following results in 1,200 cases: 50% cured, 45% improved, only 5% unsuccessful. Holznecht (Vienna), in an interesting paper, published in 1928, gives the following results: 60% cured, 20% to 30% improvement, 10% refractory to irradiation. Since then more statistics have been published with slightly better results. Christie (Washington) published the treatment results of 305 cases, of which 12% were mild, 37% grave cases and 51% of medium severity (53% with and 47% without exophthalmos); average age, thirty-seven years; average duration of the symptoms before treatment, two years; cure, that is, disappearance of the toxic symptoms and restitution of the basal metabolic rate in 89%, improvement in 8·5%, refractory 2·5%. Of 26 unsuccessfully operated cases, 24 were afterwards cured by radiation; recurrence only in four cases during an observation time of five years.

My own experience in a large number of cases of toxic goitre and so-called oligosymptomatic hyperthyreosis, some as early as 1925, are in line with the above-mentioned statistics. I prefer operation in cases of large nodular goitres with pressure symptoms. As regards the question, X rays or radium? I would like to point out that, for special technical reasons, treatment with insufficient quantities of radium is to be guarded against.

The technique is all important, and no publication has been made without stressing this fact. Repeated examinations of the basal metabolic rate or, if this is not possible, observation of the weight curve and the creatinine excretion in the urine are important. To begin the treatment with very small doses and low intensity per minute is a fundamental condition. I personally cling to the old custom of making a first treatment with lead filter inserted (and consequently no X rays reaching the patient) in order to test the patient's nervous reaction. It is sometimes astonishing to see how much of the symptoms indicating a rapid reaction, which would otherwise determine me to interrupt the treatment, is purely due to the nervous state connected with the first treatment. Another important point is to cease the radiation treatment before complete restitution (danger of hypothyreoidism). In this connexion, a simple test is very helpful, that is, the injection of 0·5 cubic centimetre of 1% adrenaline solution and observation of the pulse rate during the following hour.

Twenty years ago, when the radiation therapy of toxic goitre became generally known, three points had to be cleared up: (i) whether preliminary irradiation would lead to adhesions and render eventual subsequent operation more difficult; (ii) whether previous X ray treatment would increase bleeding during the operation; (iii) whether irradiations in too small doses would bring about functional hyperactivity of the thyreoid gland. The eventualities of points (i) and (ii) have long ago been

shown by eminent surgeons not to exist, and these objections can therefore be discarded. Regarding the third point, we know that normal thyreoid tissue is not affected by the usual therapeutic doses. Only the hyperactive thyreoid responds relatively easily to X rays; but the effect of radiation is only inhibitory and depressive. Pordes, who called attention to the fact that the first radiation can produce an increased incretion of thyreotoxin similar to this observed at operations, explained this as a result of an increased permeability of the cells, making it advisable to make the first dose as low as possible. If we find one or another case published in which the first radiation had disagreeable consequences, we can usually ascertain that Pordes's warning has not been followed.

Finally, there is no doubt that operation and radiation technique has attained a very high standard. Their aim is the reduction of the function of the thyreoid gland, whereas the final solution of the question of the treatment of hyperthyreoidism will be found in my opinion in the "complete reestablishment of the balance between the incretion of the polyglandular system on one side and the nervous regulation on the other side". Indeed, a vast field for team work and research.

Yours, etc.,

MAX MICHEL.

Wickham House,
Wickham Terrace,
Brisbane.
September 6, 1938.

SIR: Dr. Sandes, in his letter in THE MEDICAL JOURNAL OF AUSTRALIA of September 3, criticizes my statement that "X ray treatment is popular only in those places in which surgical treatment is poor", and suggests that the reverse may be the case and that surgical treatment may be popular only where radiation treatment is poor or its value unappreciated or ignored.

I feel sure that he will forgive me for pointing out that he has removed the sentence quoted from its context. The relevant portion of my Lister Oration reads as follows:

> Fifteen patients had been unsuccessfully treated by X ray therapy. This method of treatment, according to Means and Holmes, can be expected to cure one-third of the cases, to improve one-third and to fail to benefit the remaining third. It therefore follows that X ray treatment is popular only in those places where surgical treatment is poor.

I felt justified in attaching considerable significance to the opinion of the authorities whom I quoted, one of whom is a physician and the other a radiotherapist, because they have made a careful and unbiased study of this means of treatment of toxic goitre from the time when it first came into vogue. It is not surprising that Dr. Sandes, with his great experience, can remember a "goodly number of cases" in which cure resulted from radiotherapy, if it be true that this result is to be expected in one-third of the total number treated in this manner. I agree with him that its value should not be unappreciated or ignored, and took pains to direct attention to its efficacy when small portions of the thyreoid tissue regenerate after operative removal. I am not familiar with the details of the radiation technique employed in the fifteen patients in my series who had been given this treatment without success. It may have been poor, as Dr. Sandes suggests; but, in justice to my colleagues who are engaged in this work in Victoria, I must mention the fact that seven of these patients had received this treatment elsewhere—four of them in Sydney.

I endeavoured in the Listerian Oration to present an unbiased report of the results of surgical treatment of 450 patients suffering from toxic goitre, in whom incapacity for work was a prominent preoperative feature. I recognize that this is a clumsy method of treatment of this disease and shall be happy to abandon it when a survey of similar cases treated by radiation, or other means, convinces me that it is no longer necessary. I confess that I am unimpressed by arguments unsupported by evidence of this nature, and must reiterate my belief that at the present time competent surgical treatment is the best that can be offered to a patient suffering from toxic goitre, but that radiation therapy is preferable to surgical work which is attended by high mortality and morbidity rates. In other words, "X ray treatment is popular only in those places where surgical treatment is poor".

Yours, etc.,

ALAN NEWTON.

85, Spring Street,
Melbourne,
September 9, 1938.

Obituary.

PERCIVAL FRANK MANCHESTER.

WE regret to announce the death of Dr. Percival Frank Manchester, which occurred on September 4, 1938, at Young, New South Wales.

WILLIAM ABEL JAMES.

WE regret to announce the death of Dr. William Abel James, which occurred on September 7, 1938, at Sydney, New South Wales.

ALEXANDER LIVINGSTONE KERR.

WE regret to announce the death of Dr. Alexander Livingstone Kerr, which occurred on September 9, 1938, at Double Bay, New South Wales.

HARRIE CARYSFORT EDMUND DONOVAN.

WE regret to announce the death of Dr. Harrie Carysfort Edmund Donovan, which occurred on September 10, 1938, at Potts Point, New South Wales.

NOTICE.

The International Life Insurance Medical Congress.

WE have been asked to announce that the next International Life Insurance Congress will be held at Paris, from May 18 to May 21, 1939. The following subjects will be discussed: (i) "Consumption and Life Insurance", (ii) "Hyperthyreoidism in Life Insurance", (iii) "The Influence of Obesity in Life Insurance", (iv) "The Importance of Tobaccoism in Life Insurance and in Preventive Medicine", (v) "Albuminuria in Life Insurance", (vi) "The Value of Statistics in Life Insurance".

The General Secretary of the congress is Dr. P. A. Carrié, 8, Rue de Belloy, Paris (XVI°).

Books Received.

DER ZYKLUS DER FRAU. REFORM DES EHELEBENS, by J. Samuels; 1938. Holland: Amsterdam. Royal 8vo, pp. 174, with illustrations.

ARCHIVOS INTERNACIONALES DE LA HIDATIDOSIS, edited by V. P. Fontana; 1938. Montevideo: A. Amit. Imperial 8vo, pp. 308, with illustrations.

TREATMENT IN GENERAL PRACTICE. THE MANAGEMENT OF SOME MAJOR MEDICAL DISORDERS; NUMBER II. ARTICLES REPUBLISHED FROM THE BRITISH MEDICAL JOURNAL; Second Edition; 1938. Demy 8vo, pp. 447. Price: 10s. 6d. net.

MANUAL OF PUBLIC HEALTH. HYGIENE, by J. R. Currie, M.A., M.D., D.P.H., F.R.C.P.; 1938. Edinburgh: E. and S. Livingstone. Demy 8vo, pp. 337, with illustrations. Price: 15s. net.

THE UNIVERSITY OF SYDNEY: ITS HISTORY AND PROGRESS FROM ITS FOUNDATION IN 1852 TO 1938, TOGETHER WITH SHORT BIOGRAPHICAL SKETCHES OF ITS TEN CHANCELLORS, by R. A. Dallen, O.B.E.; 1938. Australia: Angus and Robertson Limited. Crown 4to, pp. 60, with numerous illustrations. Price: 5s. net.

Diary for the Month.

SEPT. 20.—New South Wales Branch, B.M.A.: Ethics Committee.
SEPT. 21.—Western Australian Branch, B.M.A.: Branch.
SEPT. 22.—New South Wales Branch, B.M.A.: Clinical Meeting.
SEPT. 23.—Queensland Branch, B.M.A.: Council.
SEPT. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.
SEPT. 28.—Victorian Branch, B.M.A.: Council.
SEPT. 29.—South Australian Branch, B.M.A.: Branch.
SEPT. 29.—New South Wales Branch, B.M.A.: Branch.
SEPT. 30.—New South Wales Branch, B.M.A.: Annual Meeting of Delegates.
OCT. 4.—New South Wales Branch, B.M.A.: Council (Quarterly).
OCT. 5.—Western Australian Branch, B.M.A.: Council.
OCT. 5.—Victorian Branch, B.M.A.: Branch.
OCT. 6.—South Australian Branch, B.M.A.: Council.
OCT. 7.—Queensland Branch, B.M.A.: Branch.
OCT. 11.—New South Wales Branch, B.M.A.: Organization and Science Committee.
OCT. 11.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
OCT. 14.—Queensland Branch, B.M.A.: Council.

Medical Appointments.

Dr. H. J. Ritchie and Dr. L. W. Dunlop have been appointed Members of the Police Medical Board of New South Wales.

* * *

Dr. H. E. Downes has been appointed a Member of the Advisory Council, pursuant to the provisions of Section 4 of the *Advisory Council Ordinance*, 1936-1937.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xviii to xxi.

BUNDABERG HOSPITALS BOARD, BUNDABERG, QUEENSLAND: Resident Medical Officer.
CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.
DEPARTMENT OF PUBLIC HEALTH, PERTH, WESTERN AUSTRALIA: Medical Officer.
GRESSWELL SANATORIUM, MONT PARK, VICTORIA: Resident Medical Officer.
RENWICK HOSPITAL FOR INFANTS, SUMMER HILL, NEW SOUTH WALES: Resident Medical Officer.
ROYAL HOBART HOSPITAL, HOBART, TASMANIA: Resident Medical Officer.
THE PRINCE HENRY HOSPITAL, SYDNEY, NEW SOUTH WALES: Fellow in Anæsthesia.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 178, North Terrace, Adelaide.	All Lodge appointments in South Australia. All contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.

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